FIG.1

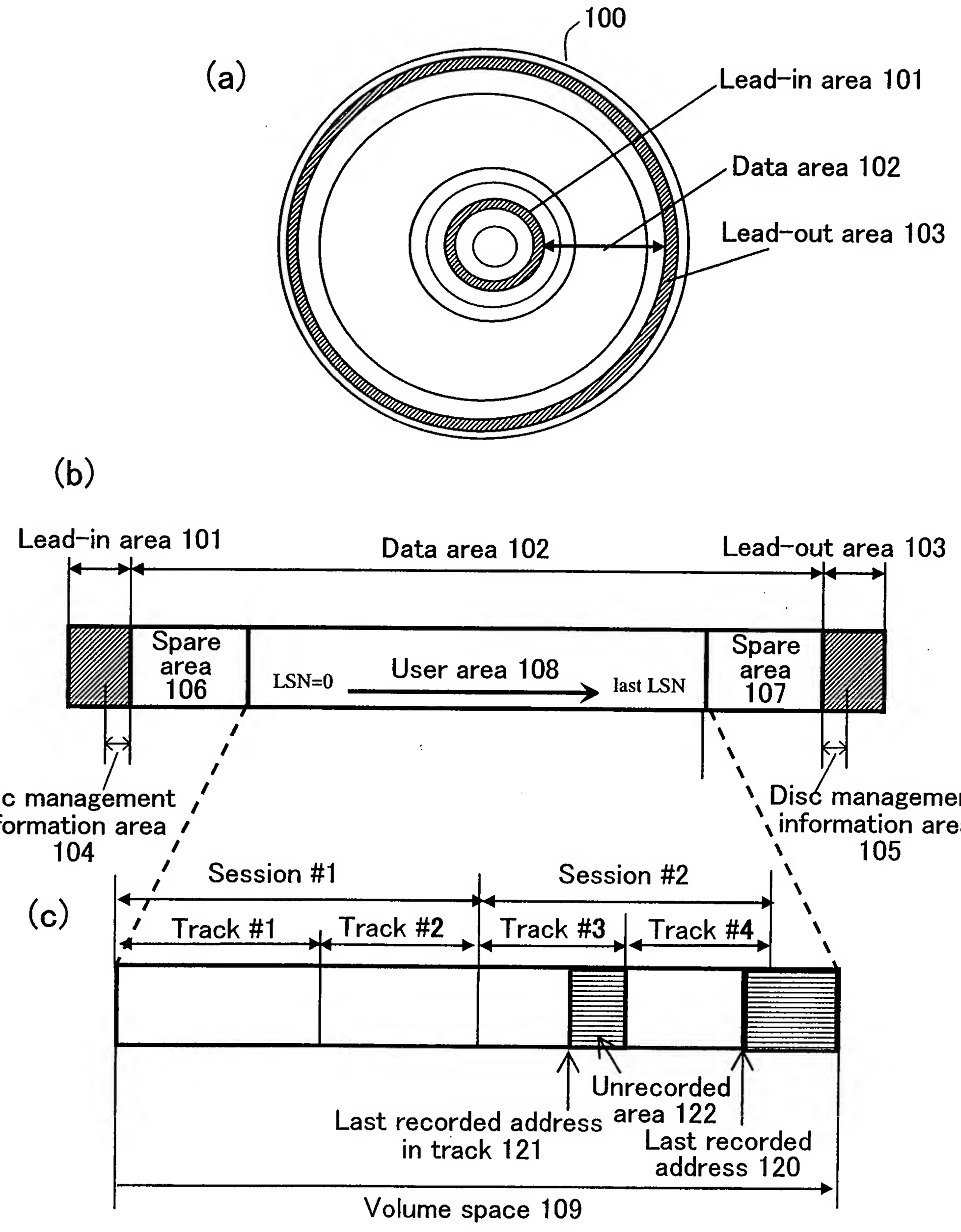
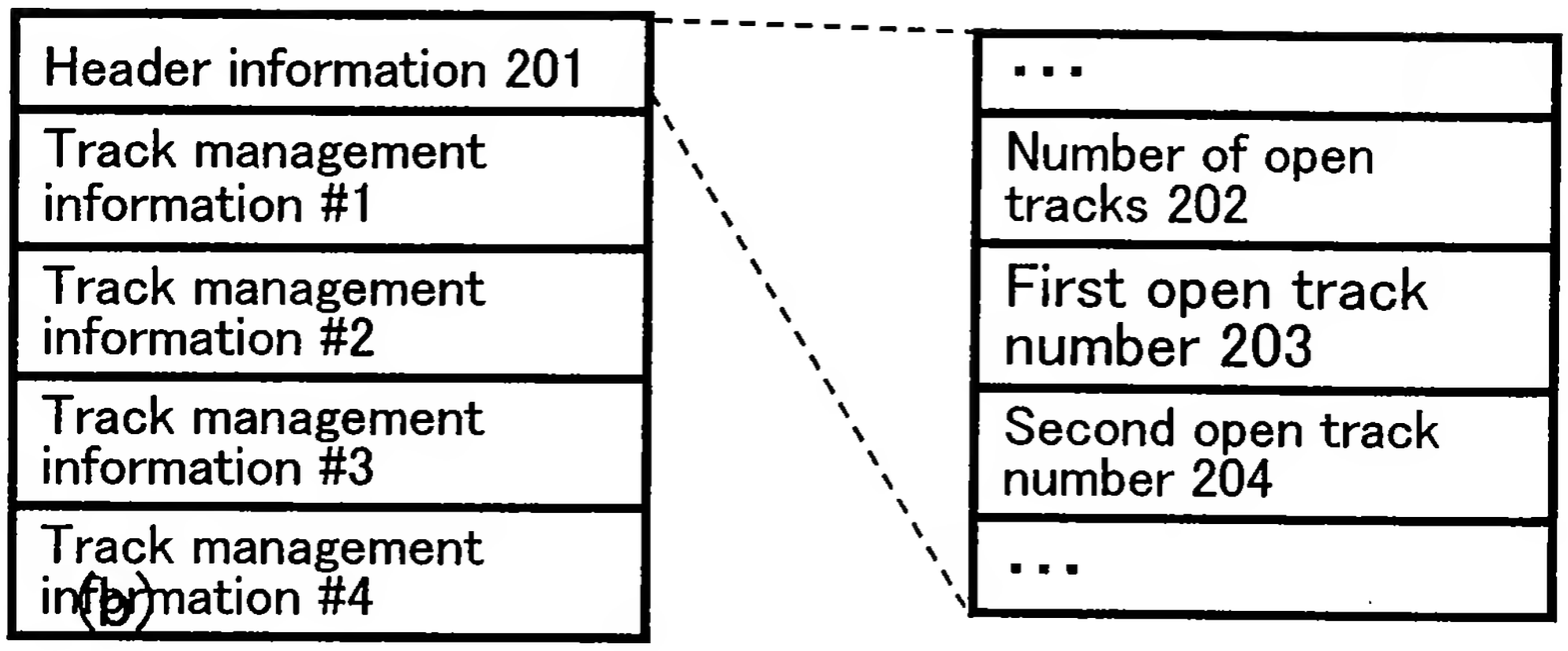

(a)
100
Lead-in area 101
Data area 102
Lead-out area 103
(b)
Lead-in area 101
Data area 102
Lead-out area 103
Spare area 106
LSN=0
User area 108
last LSN
Spare area 107
Disc management information area 104
Disc management information area 105
(c)
Session #1
Session #2
Track #1
Track #2
Track #3
Track #4
Unrecorded area 122
Last recorded address in track 121
Last recorded address 120
Volume space 109

FIG.2

(a) Session management information 200



(b) Track management information 210

Session start information 211
Track start location information 212
Last recorded address information 213

(c) Space bitmap management information 220

Header information 221
Managed area information 222
Space bitmap information 223

FIG.3A

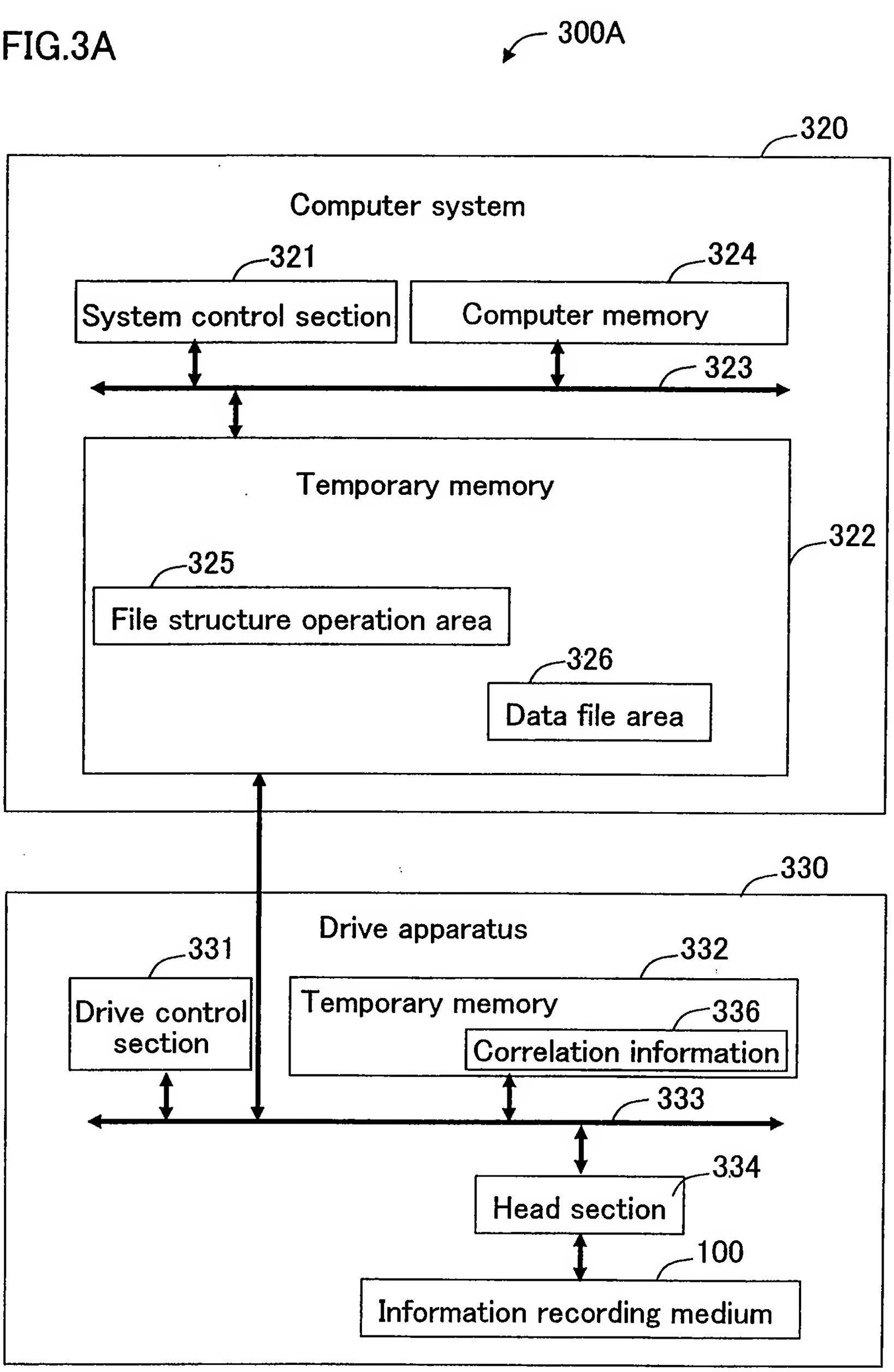

300A
320
Computer system
321
System control section
324
Computer memory
323
Temporary memory
322
325
File structure operation area
326
Data file area
330
Drive apparatus
331
Drive control section
332
Temporary memory
336
Correlation information
333
334
Head section
100
Information recording medium

FIG.3B

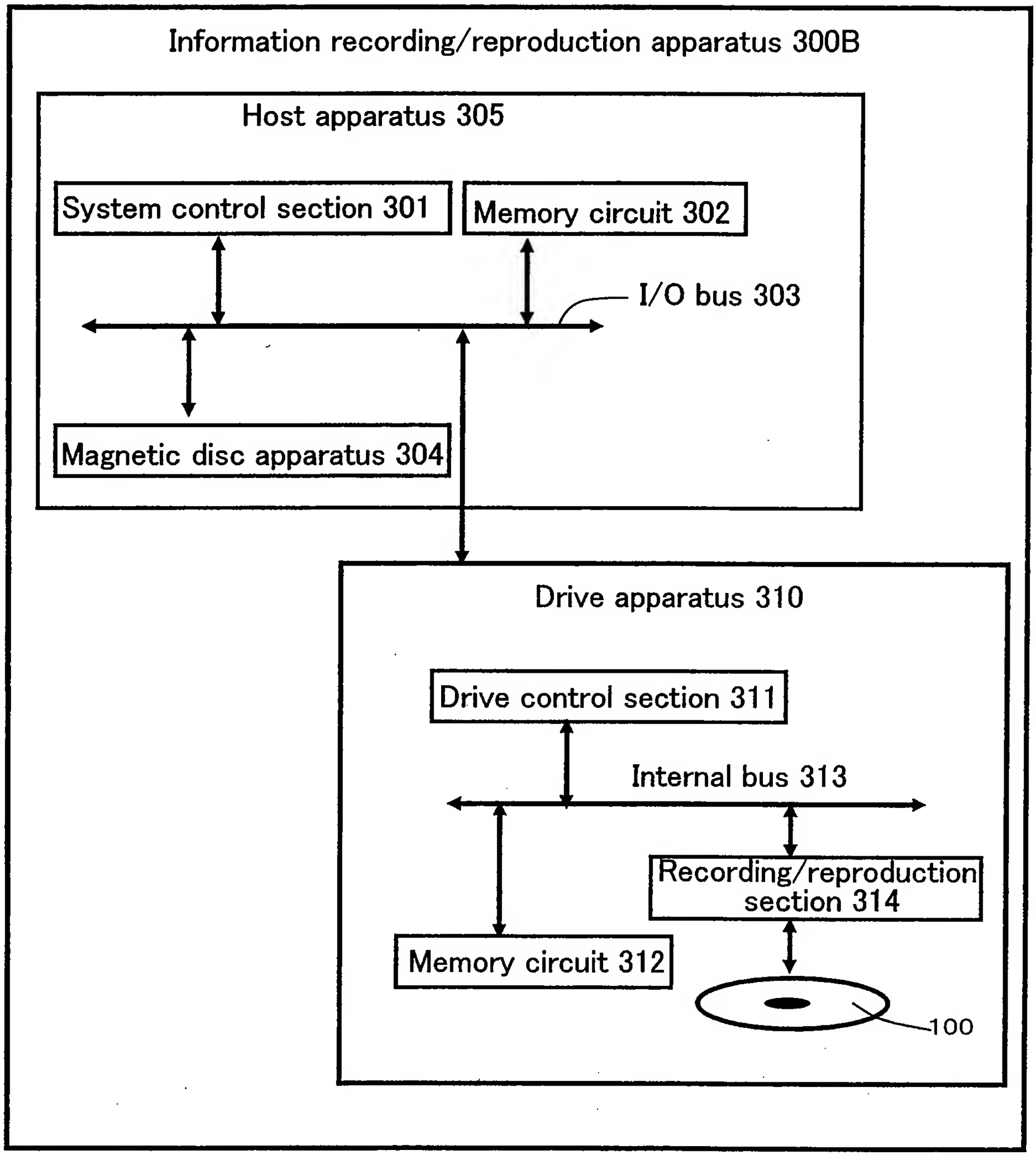

Information recording/reproduction apparatus 300B
Host apparatus 305
System control section 301
Memory circuit 302
I/O bus 303
Magnetic disc apparatus 304
Drive apparatus 310
Drive control section 311
Internal bus 313
Recording/reproduction section 314
Memory circuit 312
100

FIG.4A

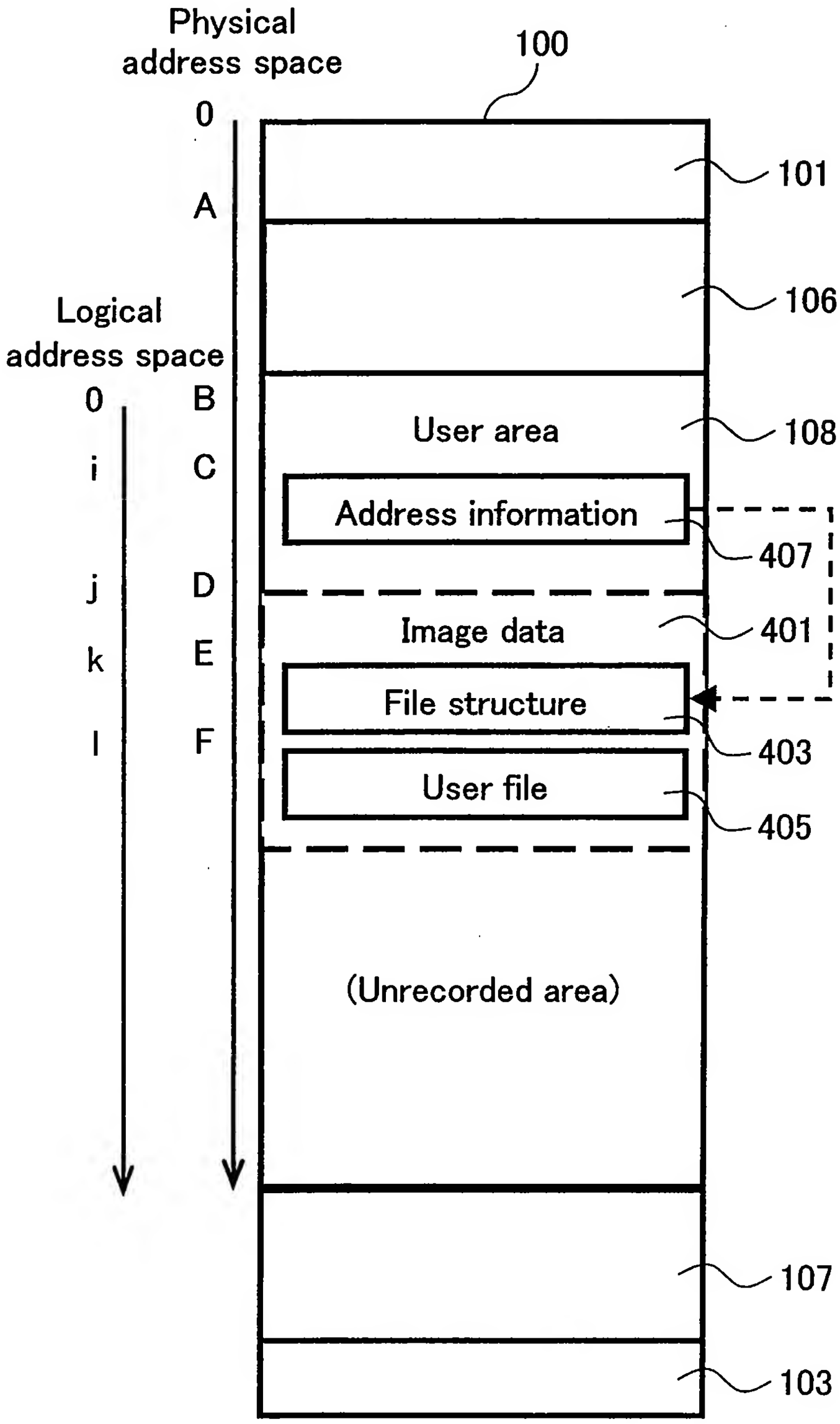

Physical address space
100
0
A
101
106
Logical address space
0
B
User area
108
i
C
Address information
407
j
D
Image data
401
k
E
File structure
403
l
F
User file
405
(Unrecorded area)
107
103

FIG.4B

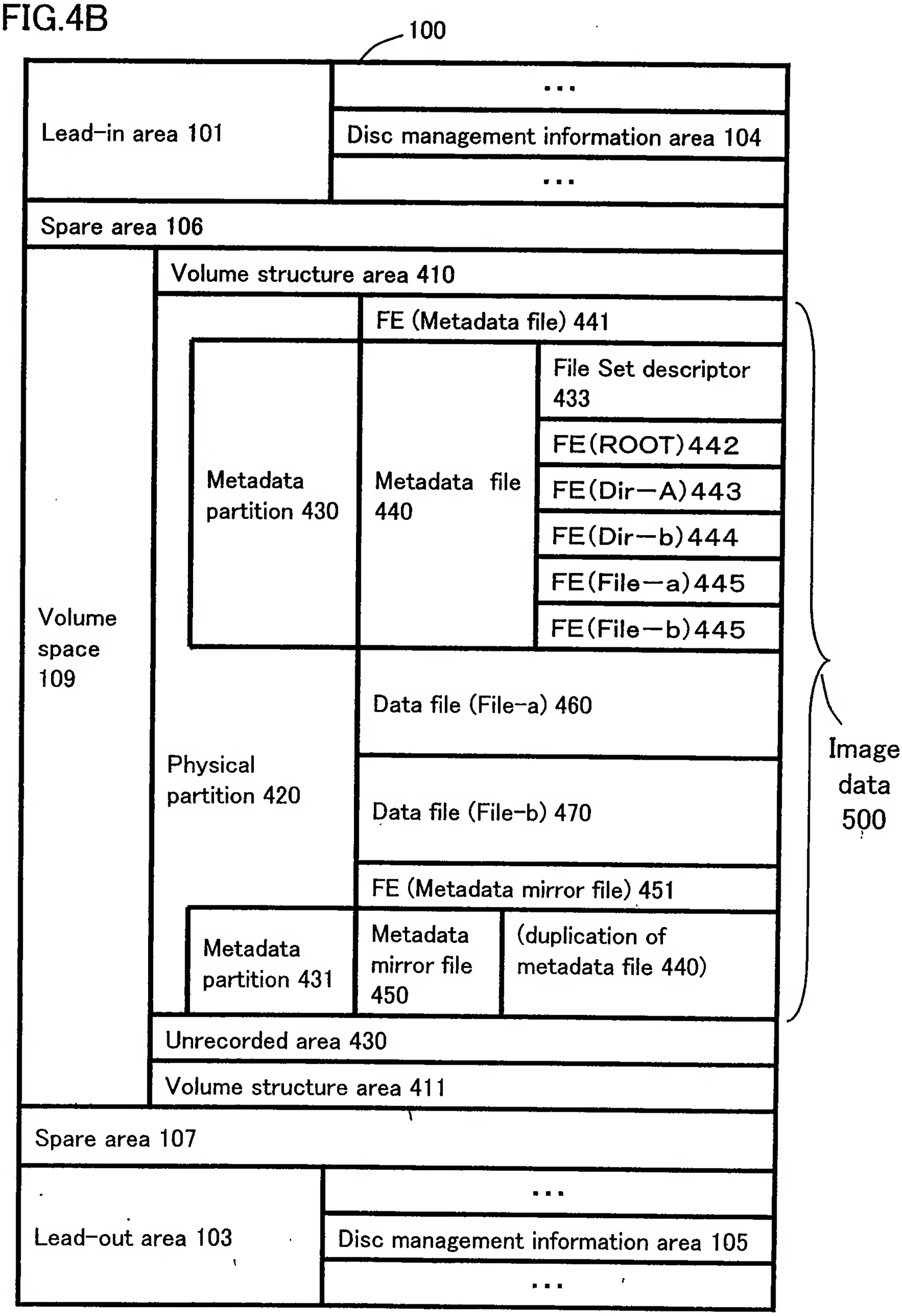

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
File Set descriptor 433
FE(ROOT)442
FE(Dir-A)443
FE(Dir-b)444
FE(File-a)445
FE(File-b)445
Volume space 109
Data file (File-a) 460
Physical partition 420
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
(duplication of metadata file 440)
Image data 500
Unrecorded area 430
Volume structure area 411
Spare area 107
Lead-out area 103
...
Disc management information area 105
...

FIG.5

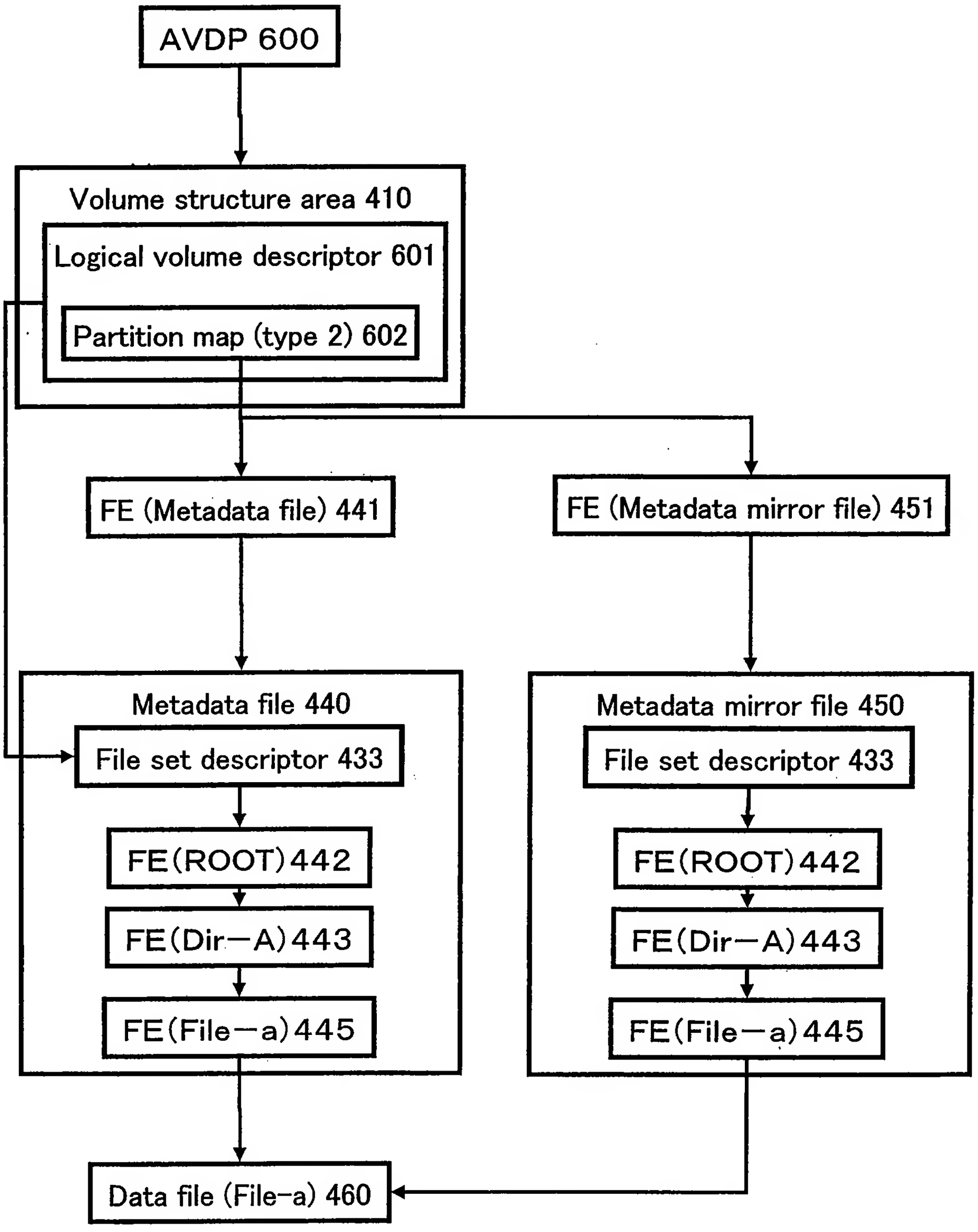

AVDP 600
Volume structure area 410
Logical volume descriptor 601
Partition map (type 2) 602
FE (Metadata file) 441
FE (Metadata mirror file) 451
Metadata file 440
File set descriptor 433
FE(ROOT)442
FE(Dir−A)443
FE(File−a)445
Metadata mirror file 450
File set descriptor 433
FE(ROOT)442
FE(Dir−A)443
FE(File−a)445
Data file (File-a) 460

FIG.6A

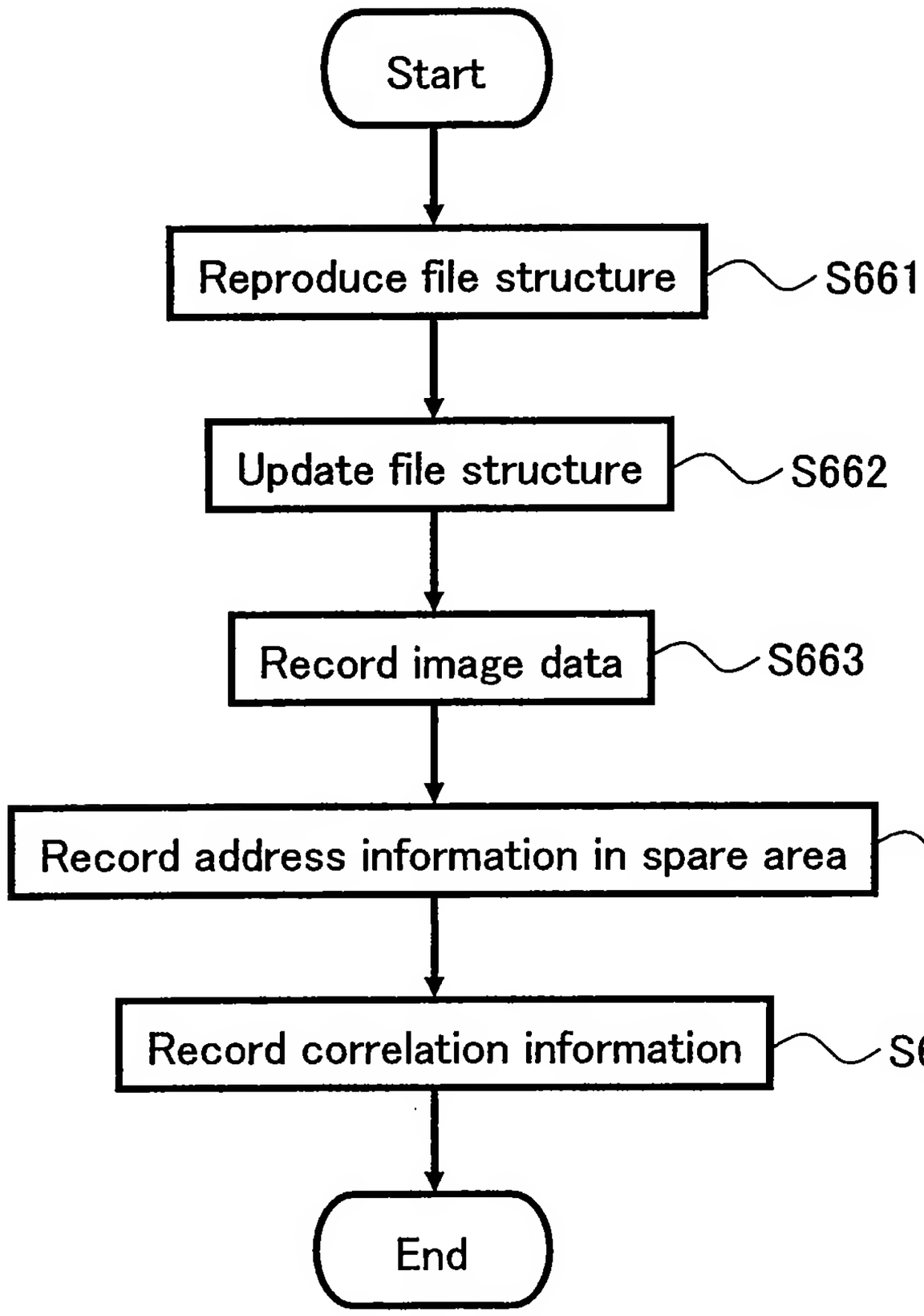

Start
Reproduce file structure
S661
Update file structure
S662
Record image data
S663
Record address information in spare area
S664
Record correlation information
S665
End

FIG.6B

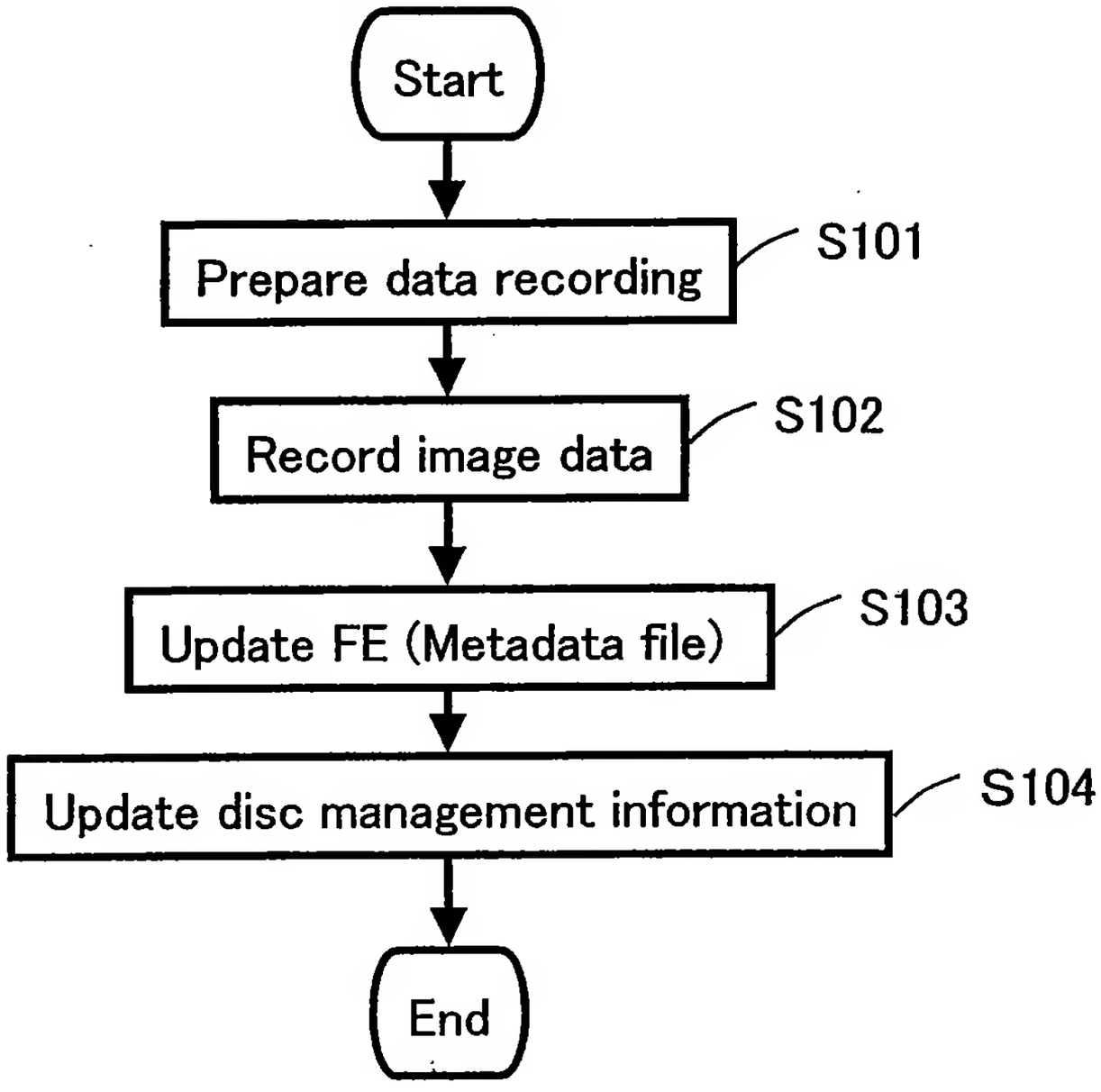

Start
Prepare data recording
S101
Record image data
S102
Update FE (Metadata file)
S103
Update disc management information
S104
End

FIG.7A

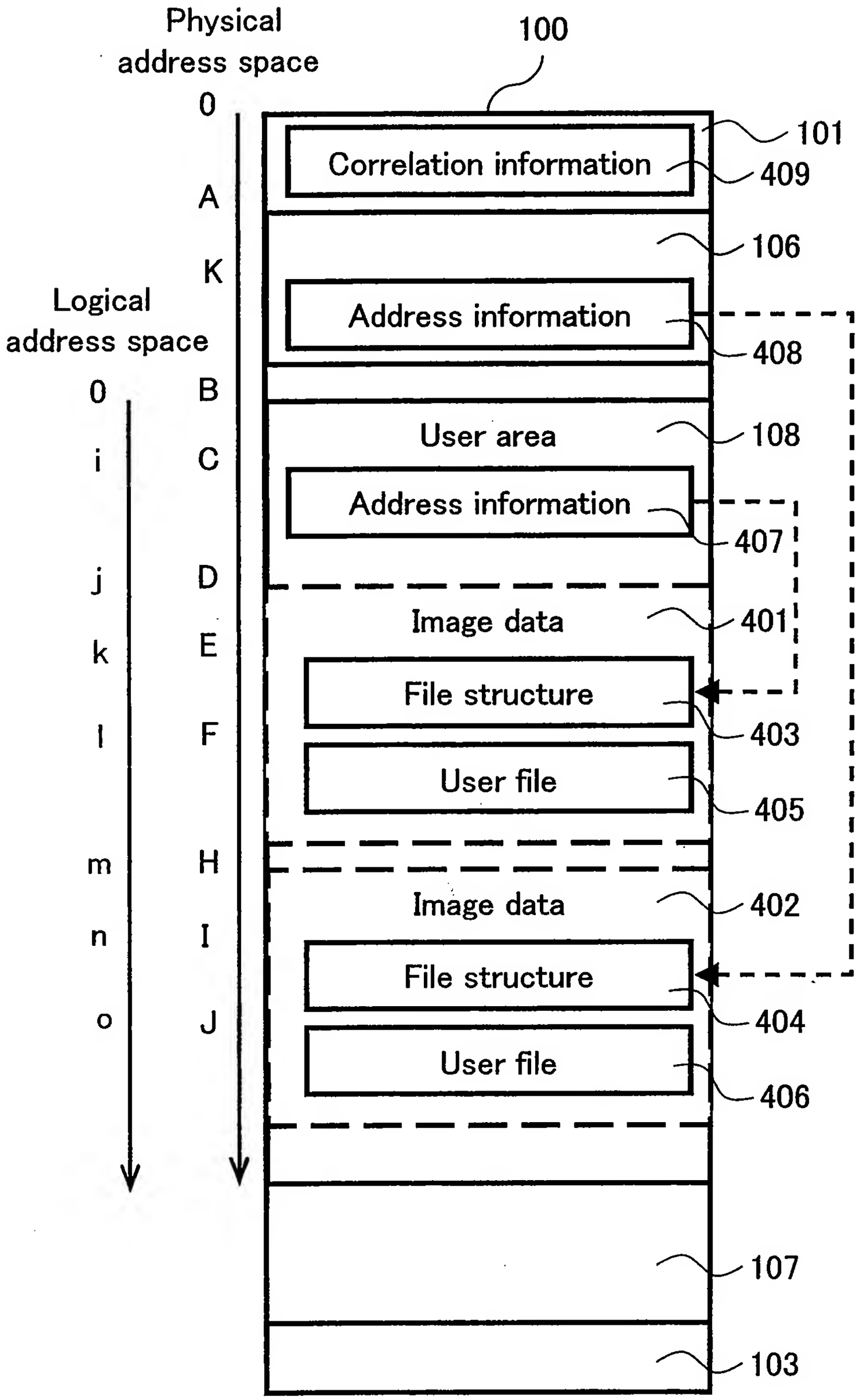

Physical address space
100
0
A
K
Logical address space
0
B
i
C
j
D
k
E
l
F
m
H
n
I
o
J
Correlation information
101
409
106
Address information
408
User area
108
Address information
407
Image data
401
File structure
403
User file
405
Image data
402
File structure
404
User file
406
107
103

FIG.7B

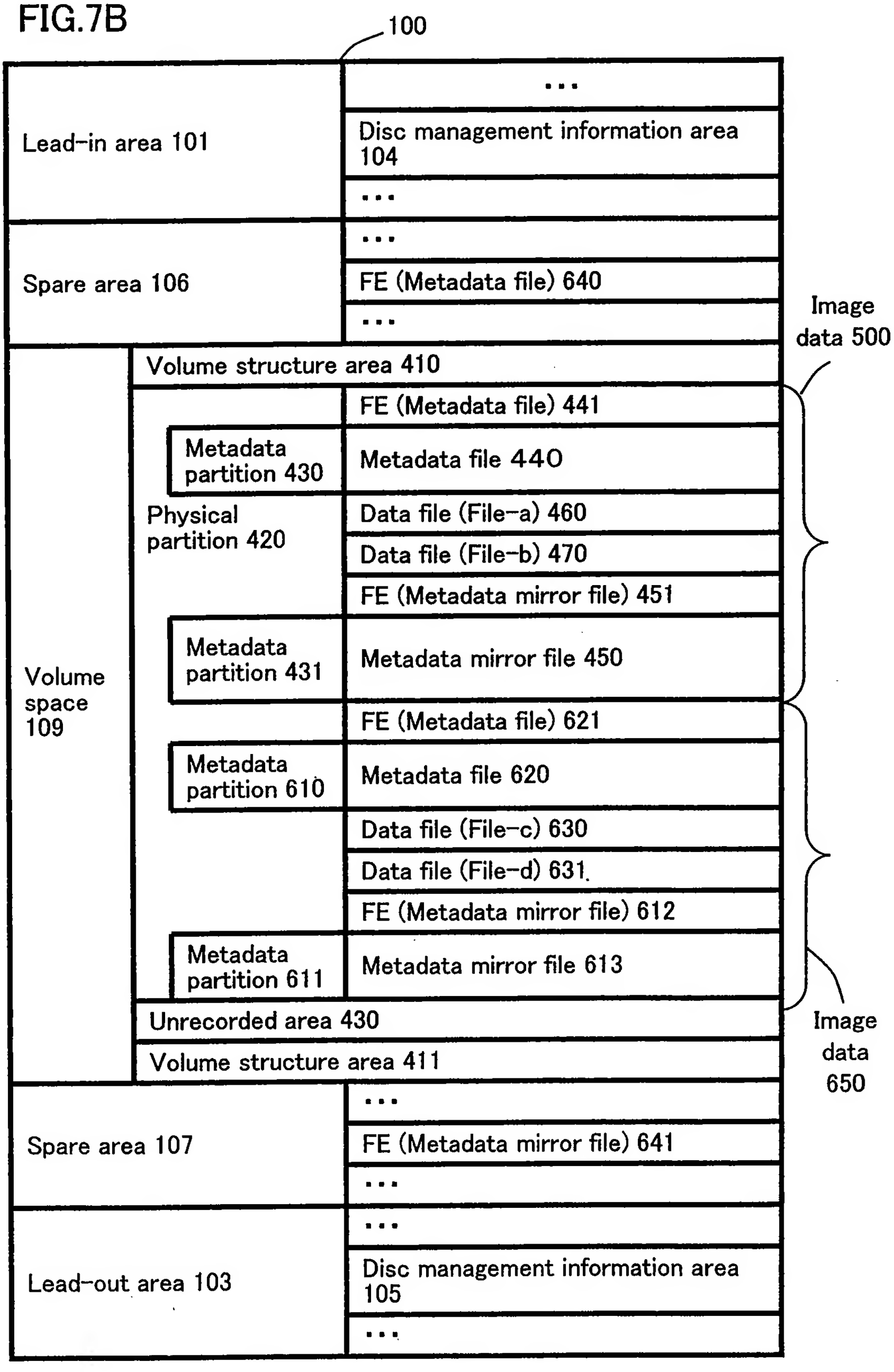

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
FE (Metadata file) 640
...
Image data 500
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
FE (Metadata file) 621
Metadata partition 610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
Unrecorded area 430
Volume structure area 411
Image data 650
...
Spare area 107
FE (Metadata mirror file) 641
...
...
Lead-out area 103
Disc management information area 105
...

FIG.8A

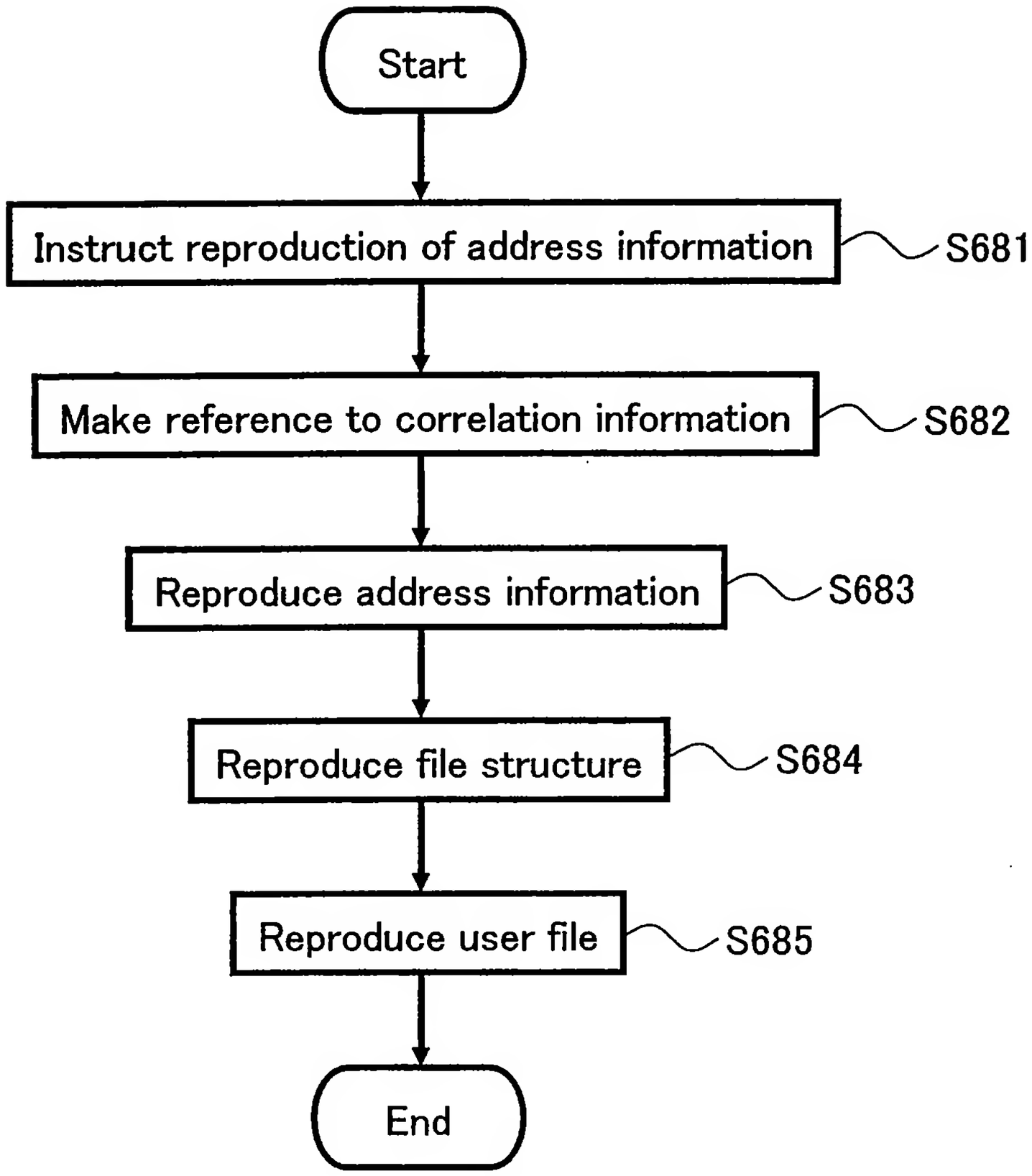

Start
Instruct reproduction of address information
S681
Make reference to correlation information
S682
Reproduce address information
S683
Reproduce file structure
S684
Reproduce user file
S685
End

FIG.8B

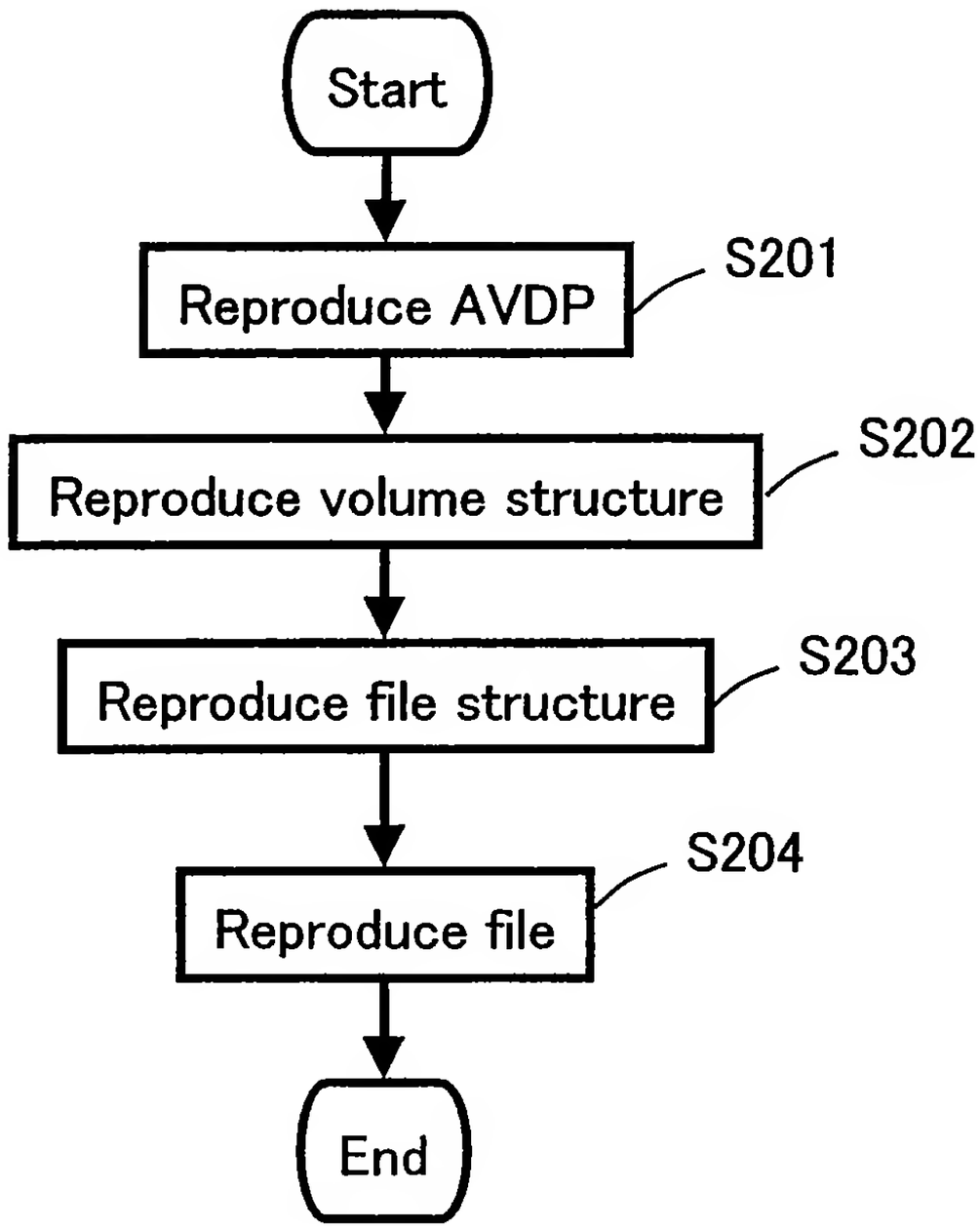

Start
Reproduce AVDP
S201
Reproduce volume structure
S202
Reproduce file structure
S203
Reproduce file
S204
End

FIG.9

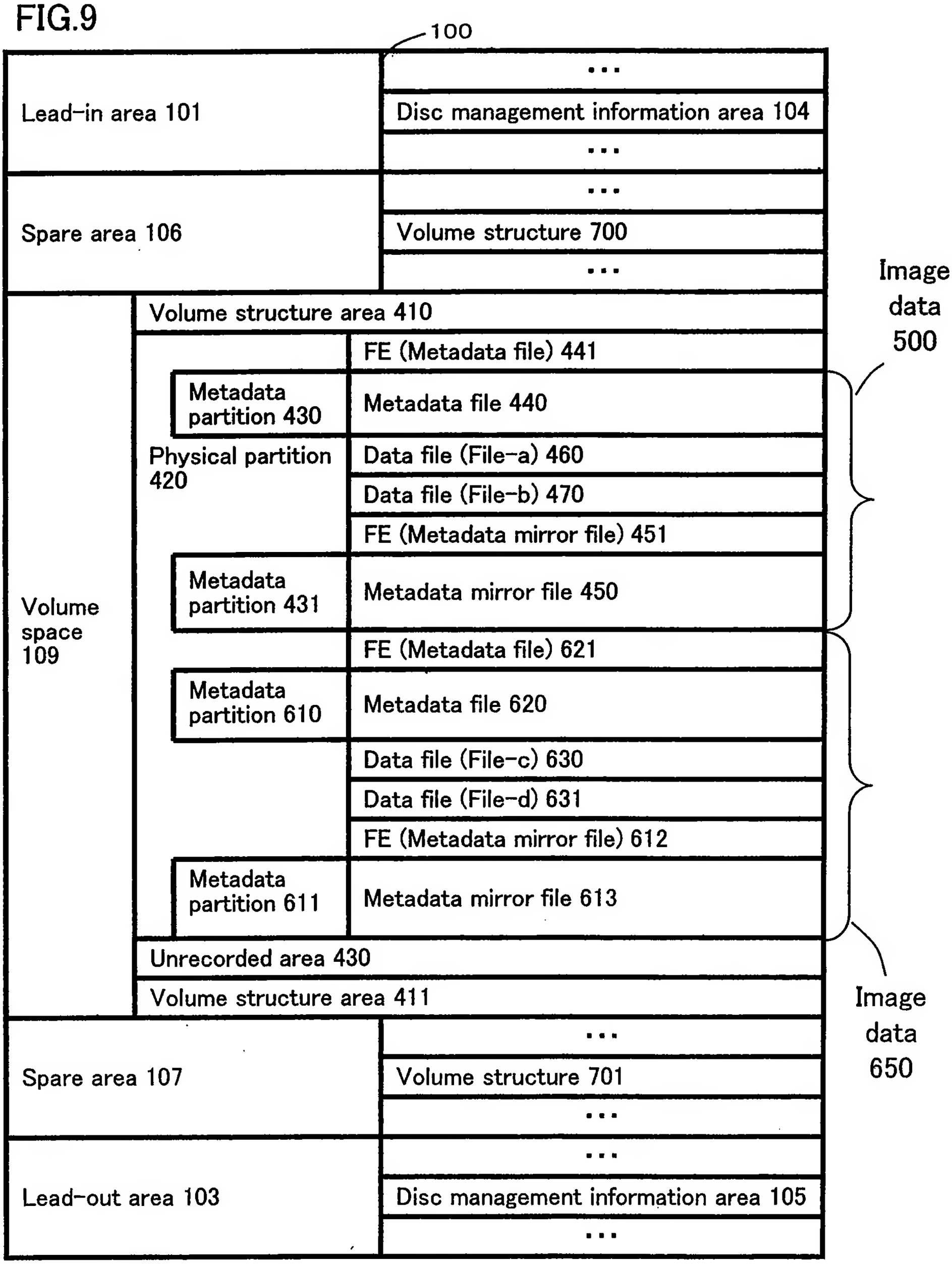

100
Lead-in area 101
Disc management information area 104
Spare area 106
Volume structure 700
Image data 500
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Volume space 109
FE (Metadata file) 621
Metadata partition 610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
Unrecorded area 430
Volume structure area 411
Image data 650
Spare area 107
Volume structure 701
Lead-out area 103
Disc management information area 105

FIG.10

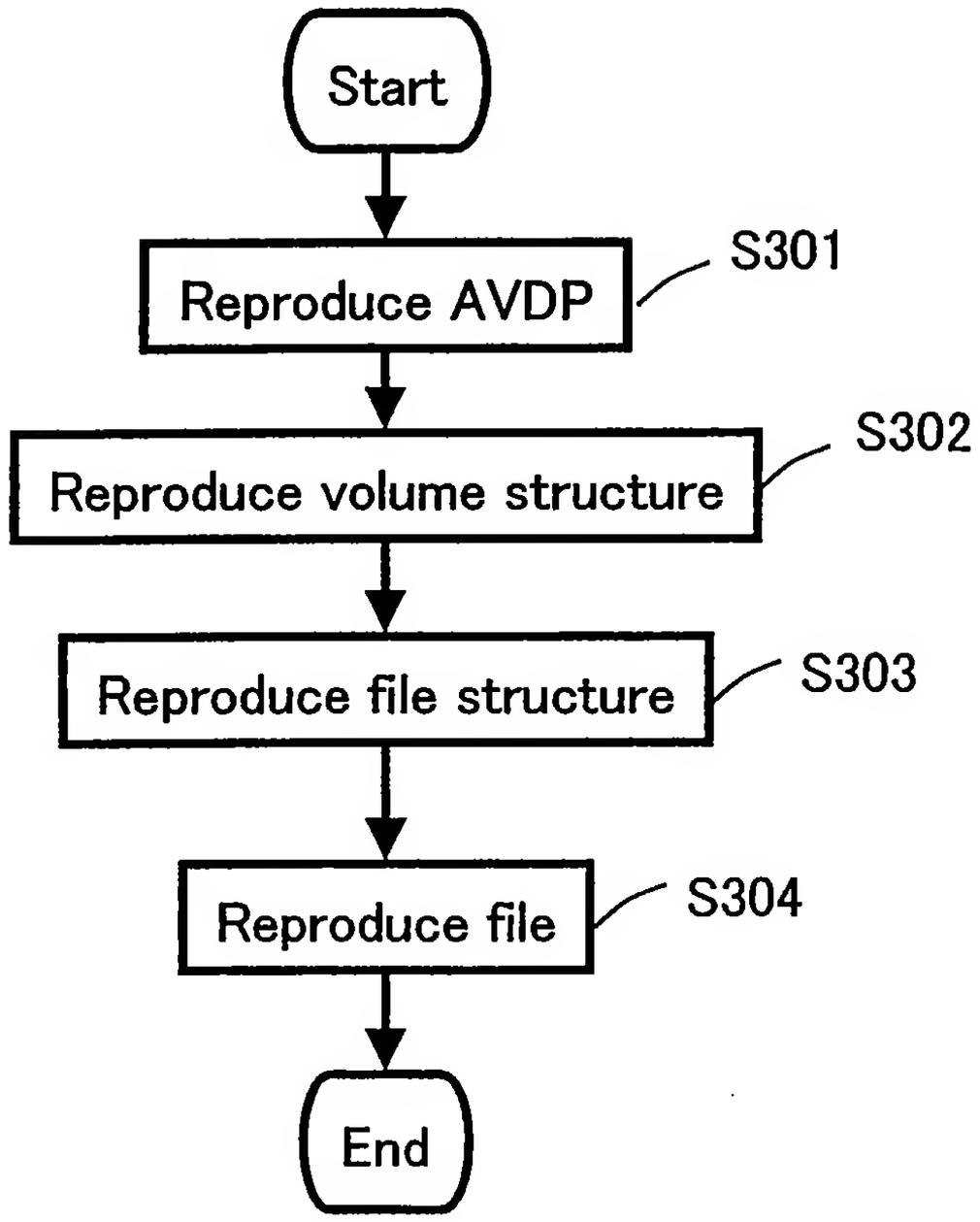

Start
Reproduce AVDP
S301
Reproduce volume structure
S302
Reproduce file structure
S303
Reproduce file
S304
End

FIG.11

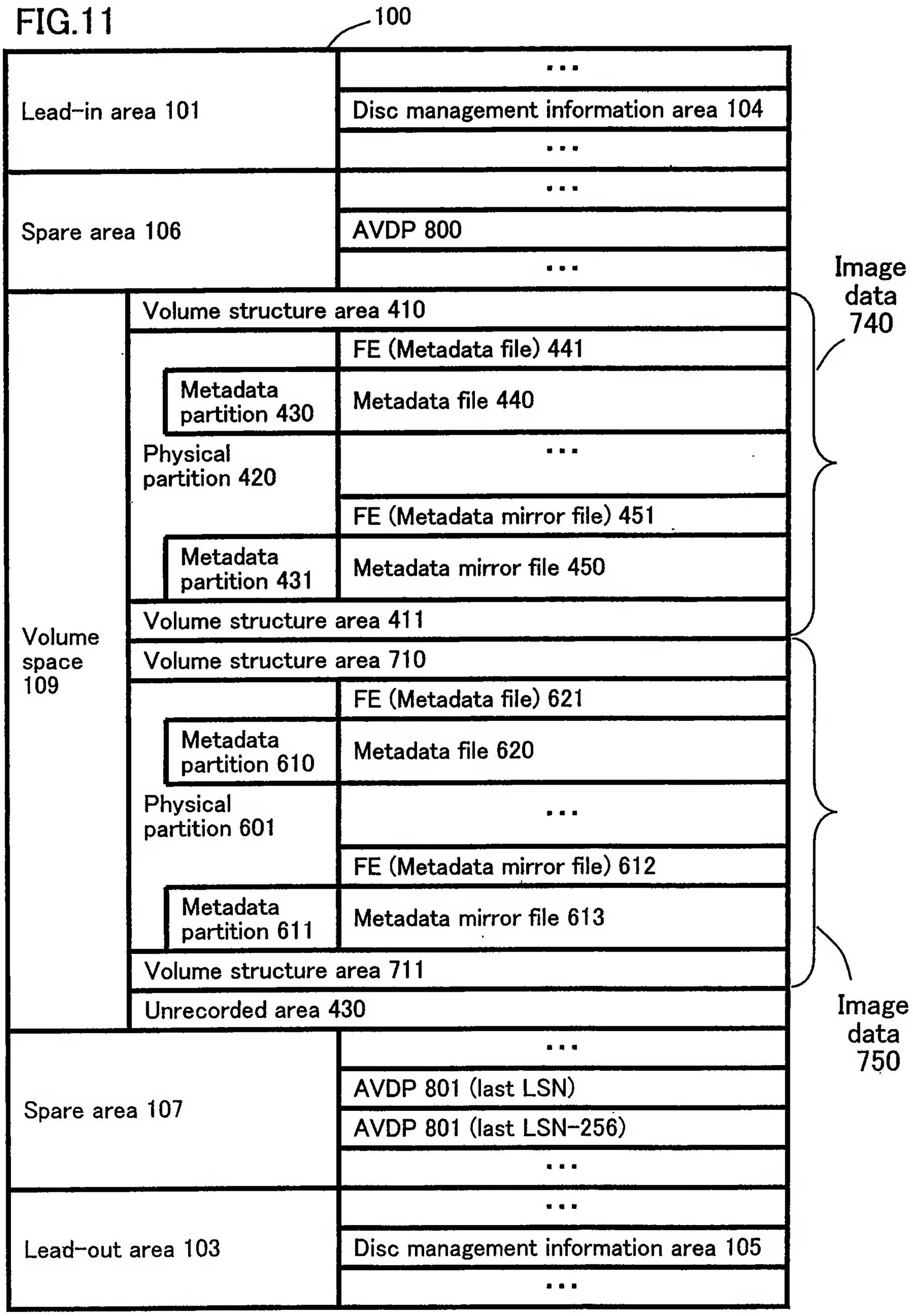

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
AVDP 800
...
Image data 740
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
...
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Volume structure area 411
Volume structure area 710
FE (Metadata file) 621
Metadata partition 610
Metadata file 620
Physical partition 601
...
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
Volume structure area 711
Unrecorded area 430
Image data 750
...
Spare area 107
AVDP 801 (last LSN)
AVDP 801 (last LSN-256)
...
...
Lead-out area 103
Disc management information area 105
...

FIG.12

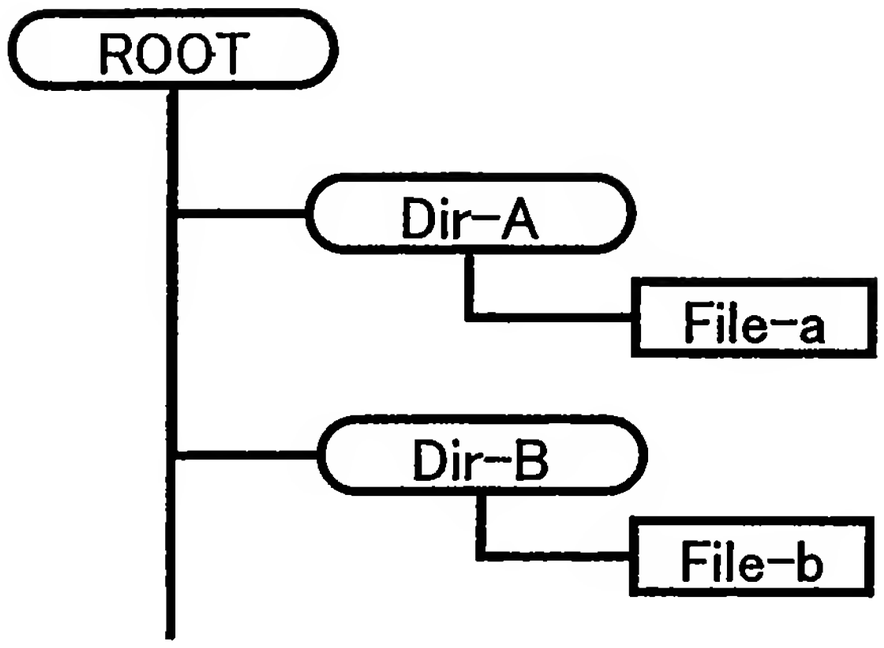


FIG.13

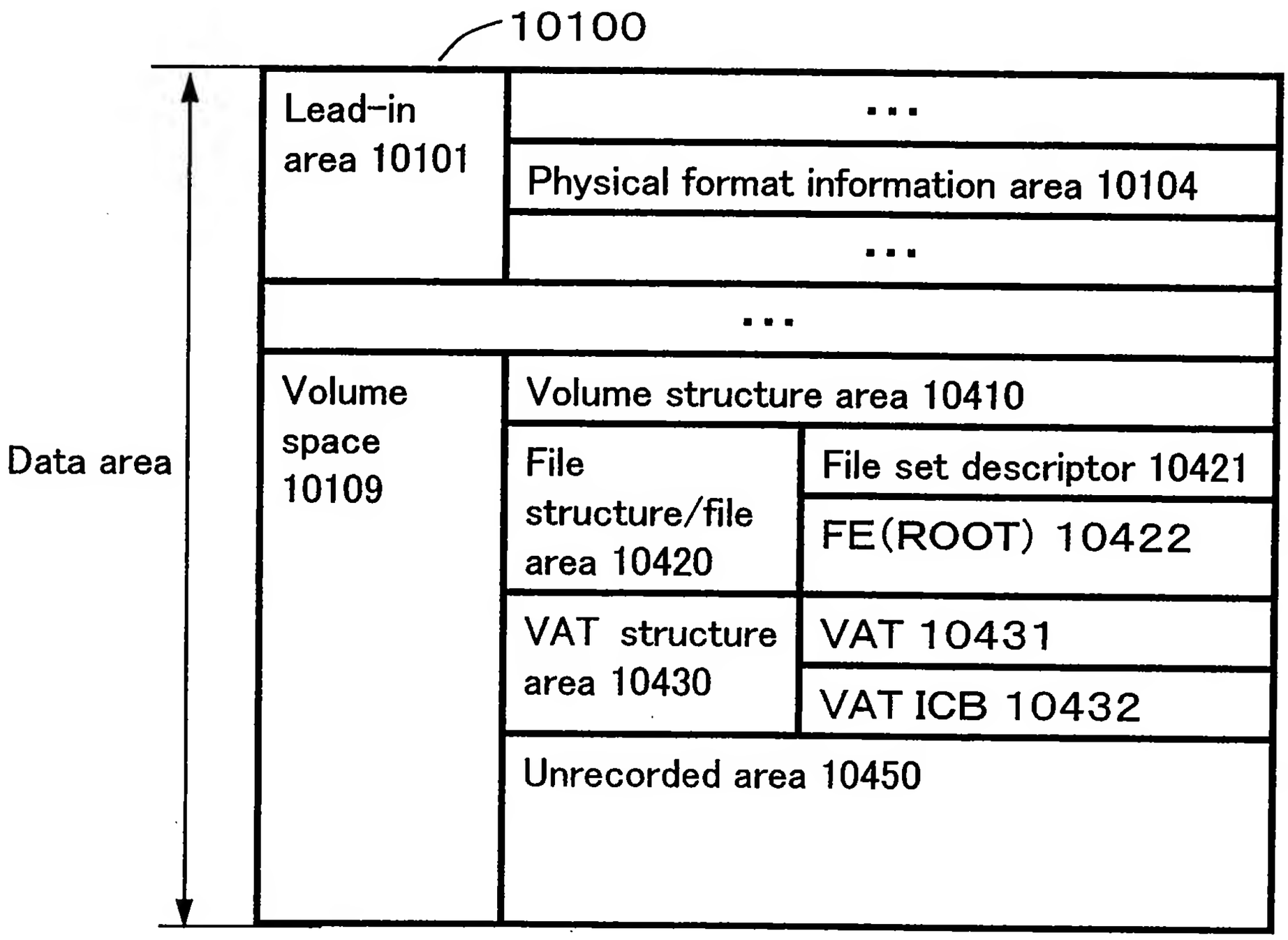

10100
Lead-in area 10101
...
Physical format information area 10104
...
...
Data area
Volume space 10109
Volume structure area 10410
File structure/file area 10420
File set descriptor 10421
FE(ROOT) 10422
VAT structure area 10430
VAT 10431
VAT ICB 10432
Unrecorded area 10450

FIG.14

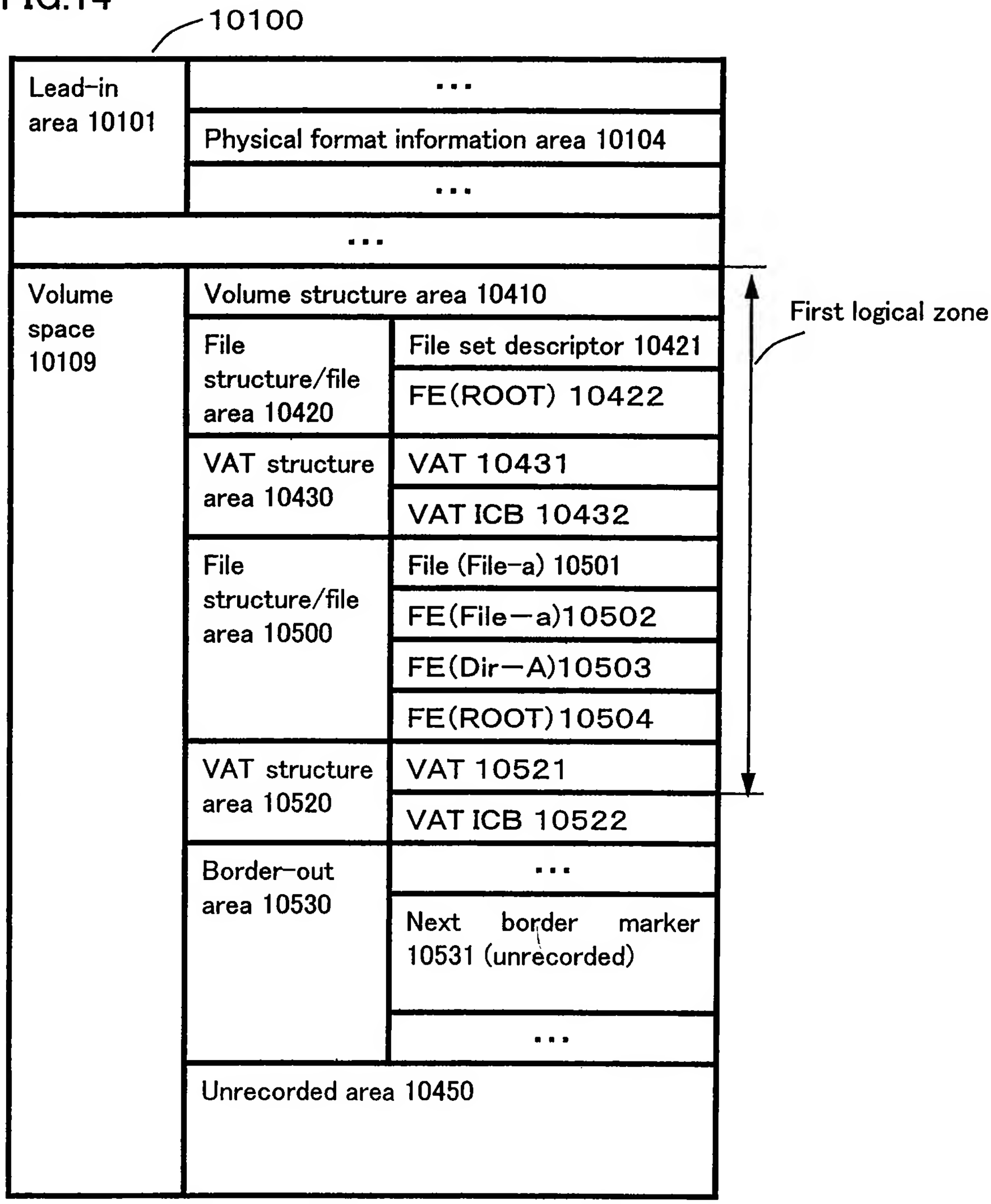

10100
Lead-in area 10101
...
Physical format information area 10104
...
...
Volume space 10109
Volume structure area 10410
File structure/file area 10420
File set descriptor 10421
FE(ROOT) 10422
VAT structure area 10430
VAT 10431
VAT ICB 10432
File structure/file area 10500
File (File-a) 10501
FE(File-a)10502
FE(Dir-A)10503
FE(ROOT)10504
VAT structure area 10520
VAT 10521
VAT ICB 10522
Border-out area 10530
...
Next border marker 10531 (unrecorded)
...
Unrecorded area 10450
First logical zone

FIG.15

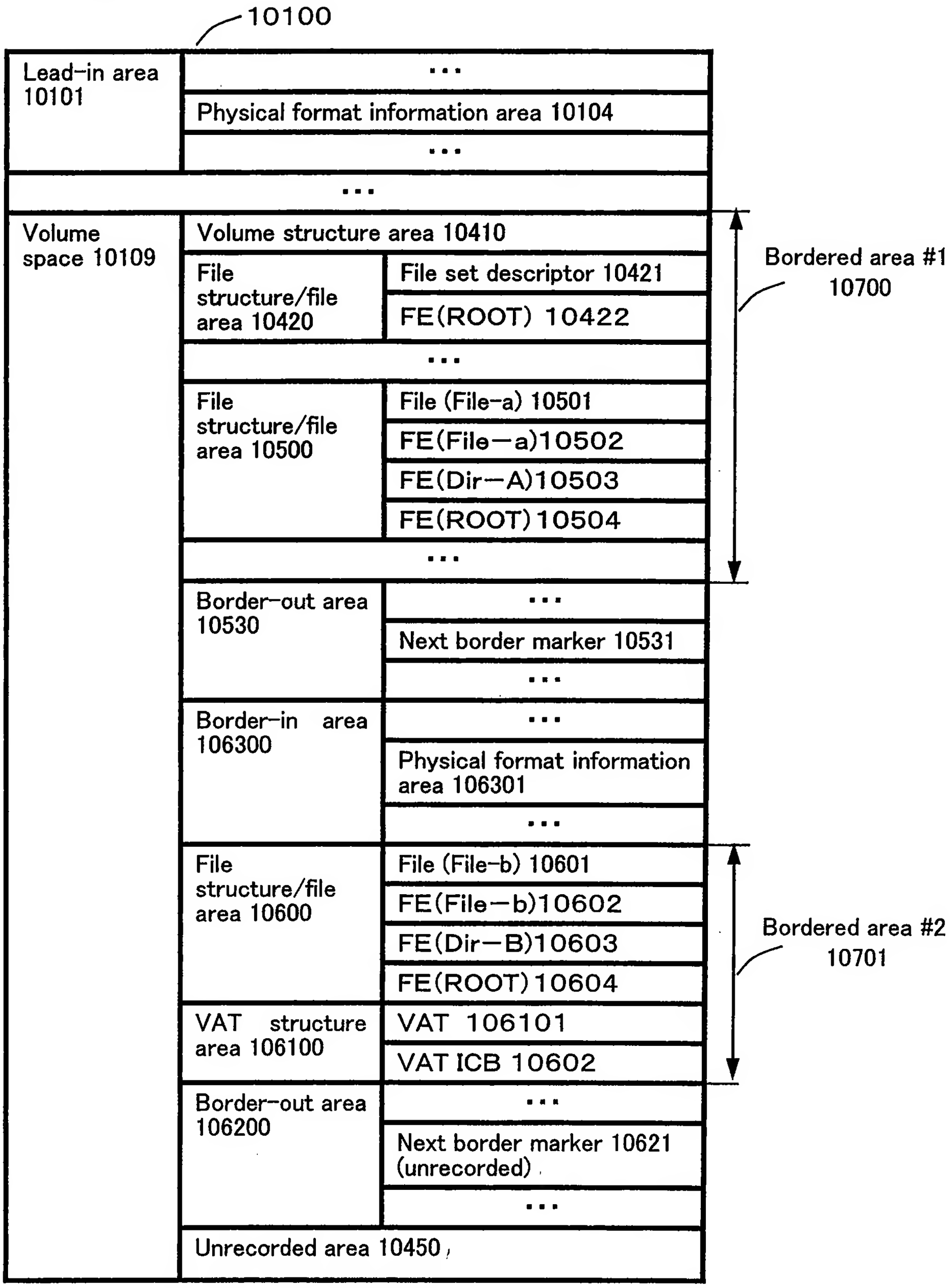

10100
Lead-in area 10101
...
Physical format information area 10104
...
...
Volume space 10109
Volume structure area 10410
File structure/file area 10420
File set descriptor 10421
FE(ROOT) 10422
...
...
File structure/file area 10500
File (File-a) 10501
FE(File-a)10502
FE(Dir-A)10503
FE(ROOT)10504
...
Border-out area 10530
...
Next border marker 10531
...
Border-in area 106300
...
Physical format information area 106301
...
Bordered area #1 10700
File structure/file area 10600
File (File-b) 10601
FE(File-b)10602
FE(Dir-B)10603
FE(ROOT)10604
VAT structure area 106100
VAT 106101
VAT ICB 10602
Bordered area #2 10701
Border-out area 106200
...
Next border marker 10621 (unrecorded)
...
Unrecorded area 10450

FIG.16

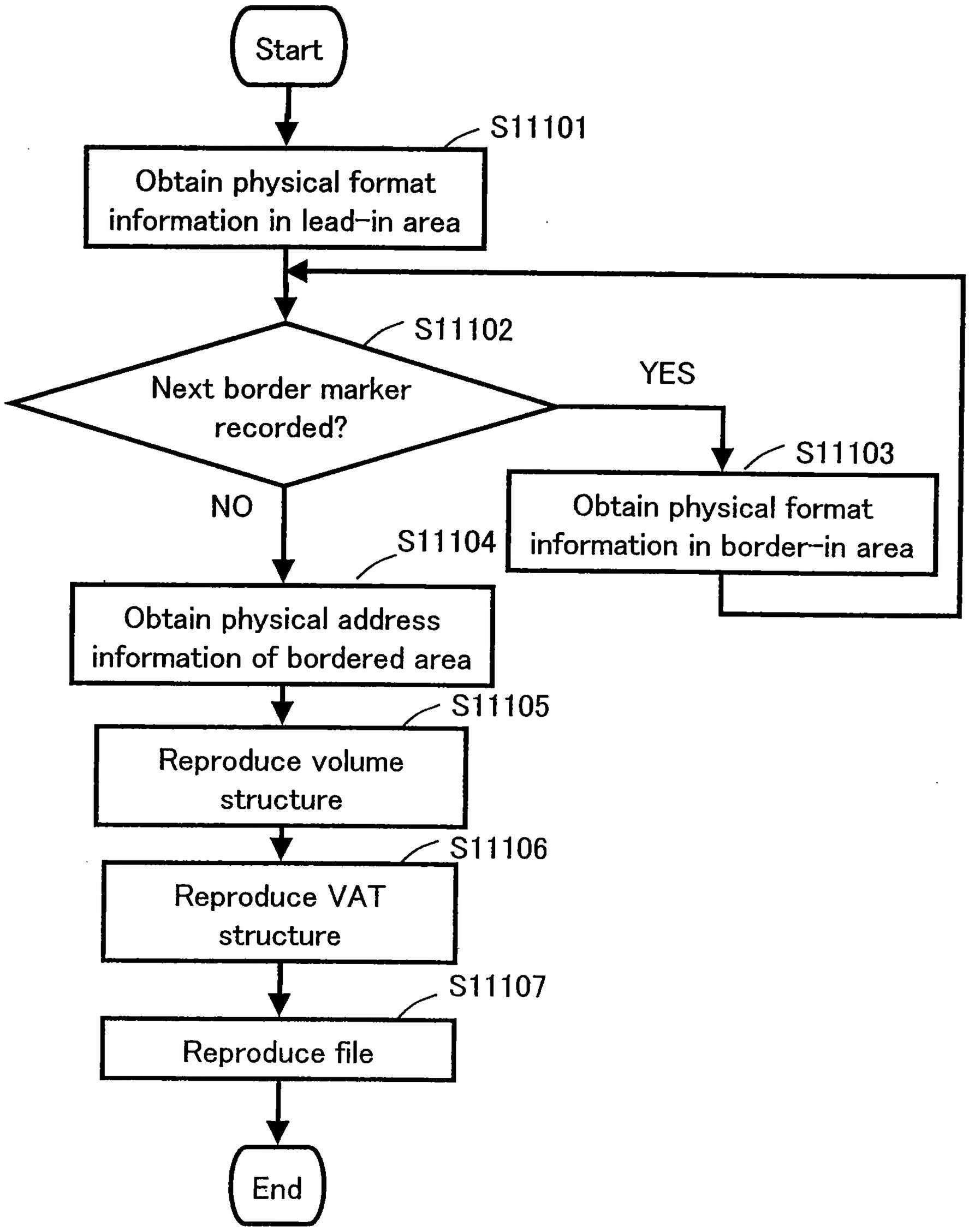

Start
S11101
Obtain physical format information in lead-in area
S11102
Next border marker recorded?
YES
S11103
Obtain physical format information in border-in area
NO
S11104
Obtain physical address information of bordered area
S11105
Reproduce volume structure
S11106
Reproduce VAT structure
S11107
Reproduce file
End

FIG.17

(a) Replacement management information list 1000

Header information 1001
Replacement management information #1
Replacement management information #2
Replacement management information #3
...
Terminator information
00h

(b) Replacement management information 1010

Status information 1011
Original location information 1012
Replacement location information 1013

FIG.18

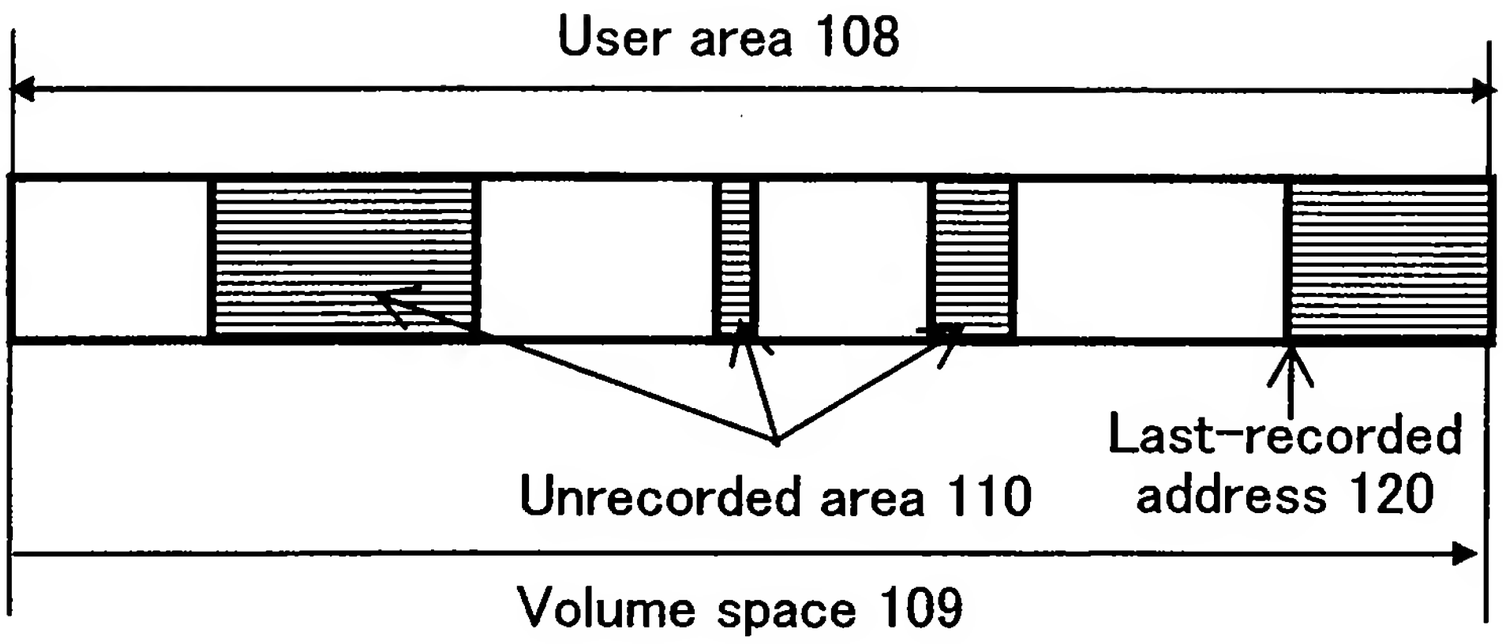

User area 108
Unrecorded area 110
Last-recorded address 120
Volume space 109

FIG.19

Disc structure information 1100

General information 1101
Replacement management information list location information 1102
User area start location information 1103
User area end location information 1104
Spare area information 1105
Recording mode information 1106
Last recorded address information 1107
Spare area management information 1108
Session management information location information 1109
Space bitmap management information location information 1110

FIG.20

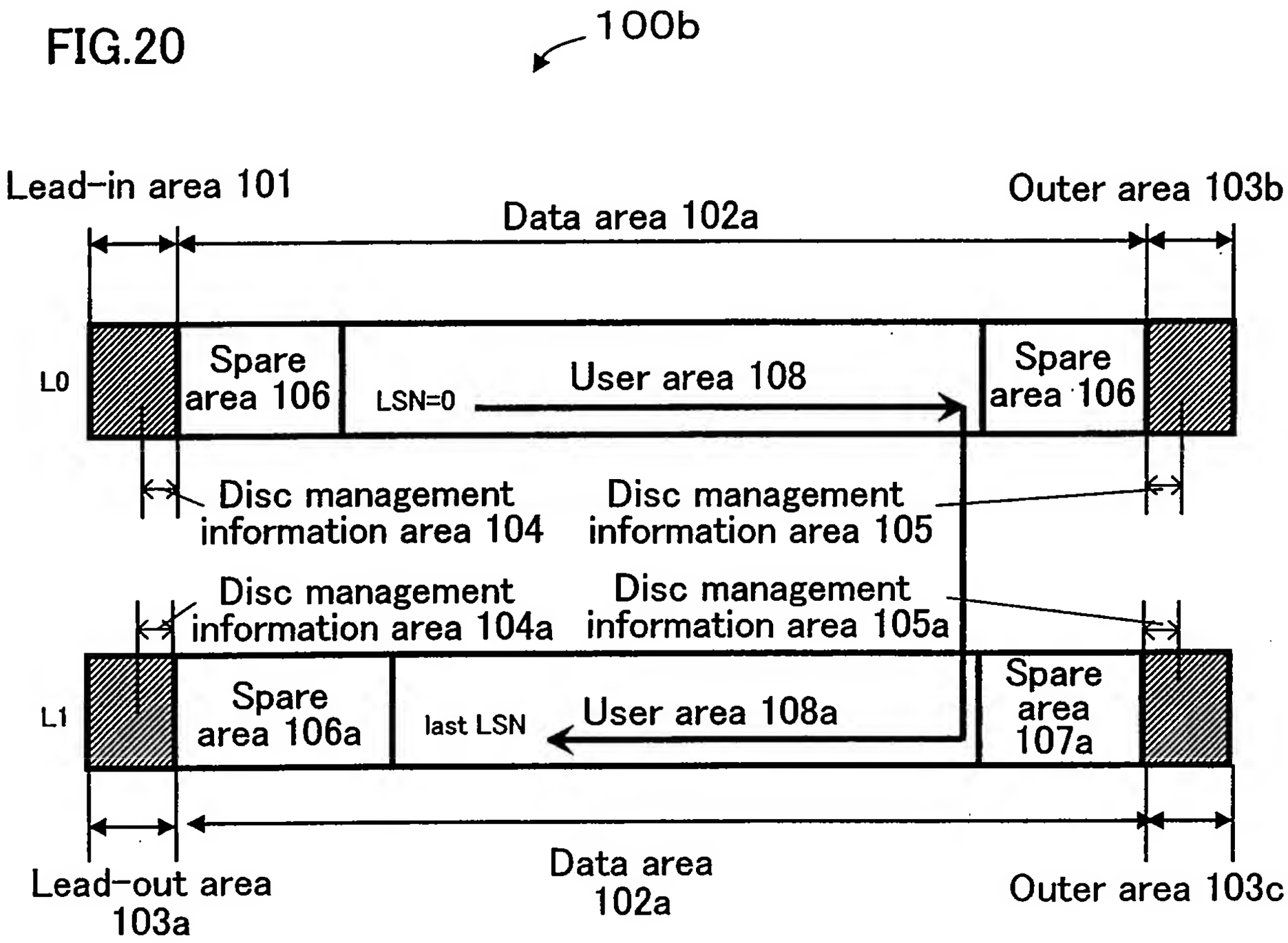
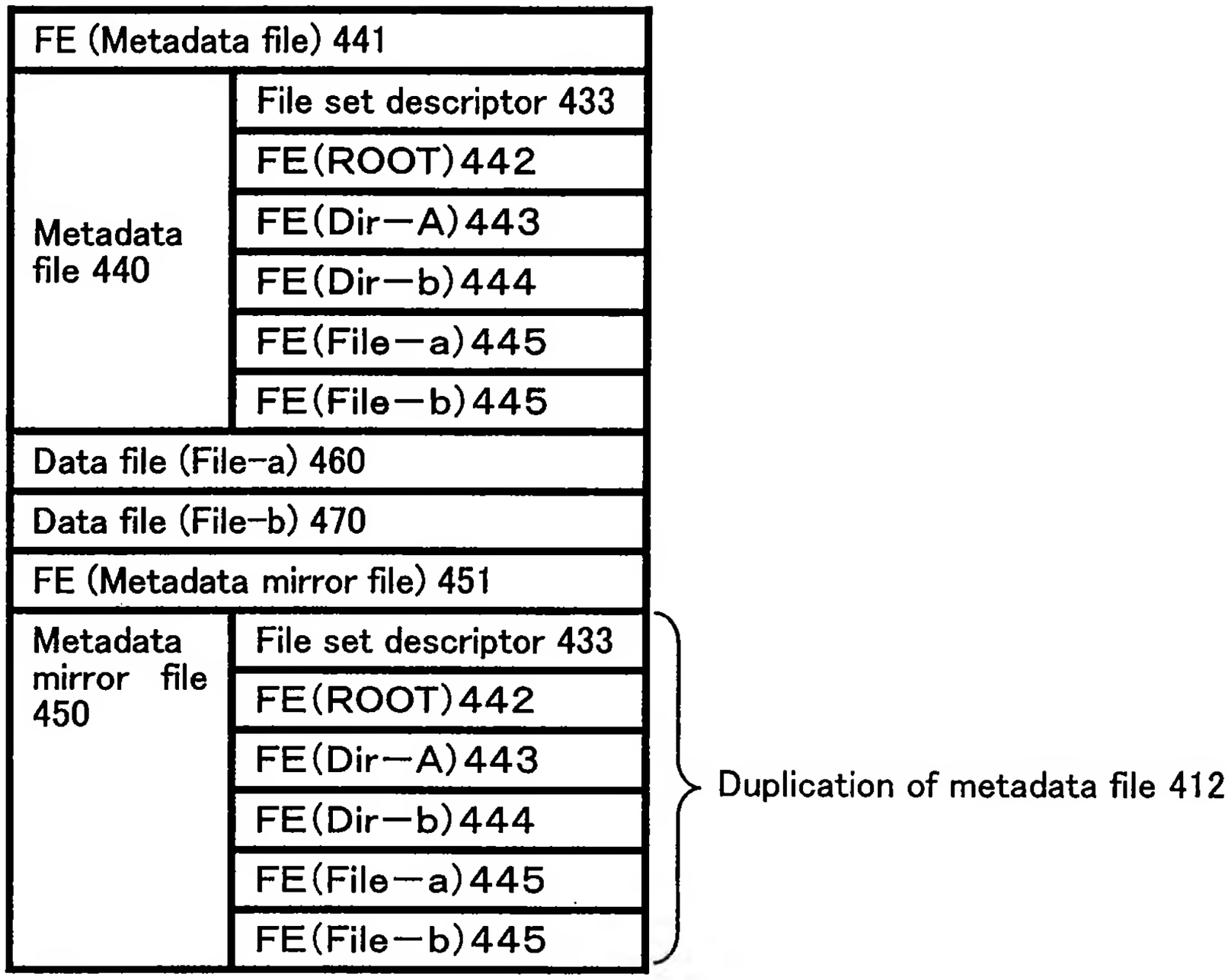

100b
Lead-in area 101
Data area 102a
Outer area 103b
L0
Spare area 106
LSN=0
User area 108
Spare area 106
Disc management information area 104
Disc management information area 105
Disc management information area 104a
Disc management information area 105a
L1
Spare area 106a
last LSN
User area 108a
Spare area 107a
Lead-out area 103a
Data area 102a
Outer area 103c

FIG.21

(a) The structure of image data 500



(b) An example of different data arrangement in metadata file 440

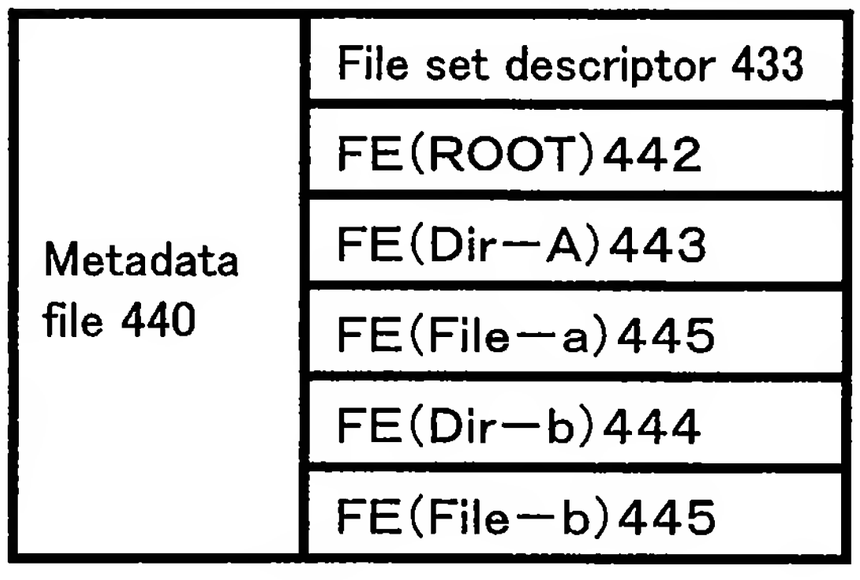
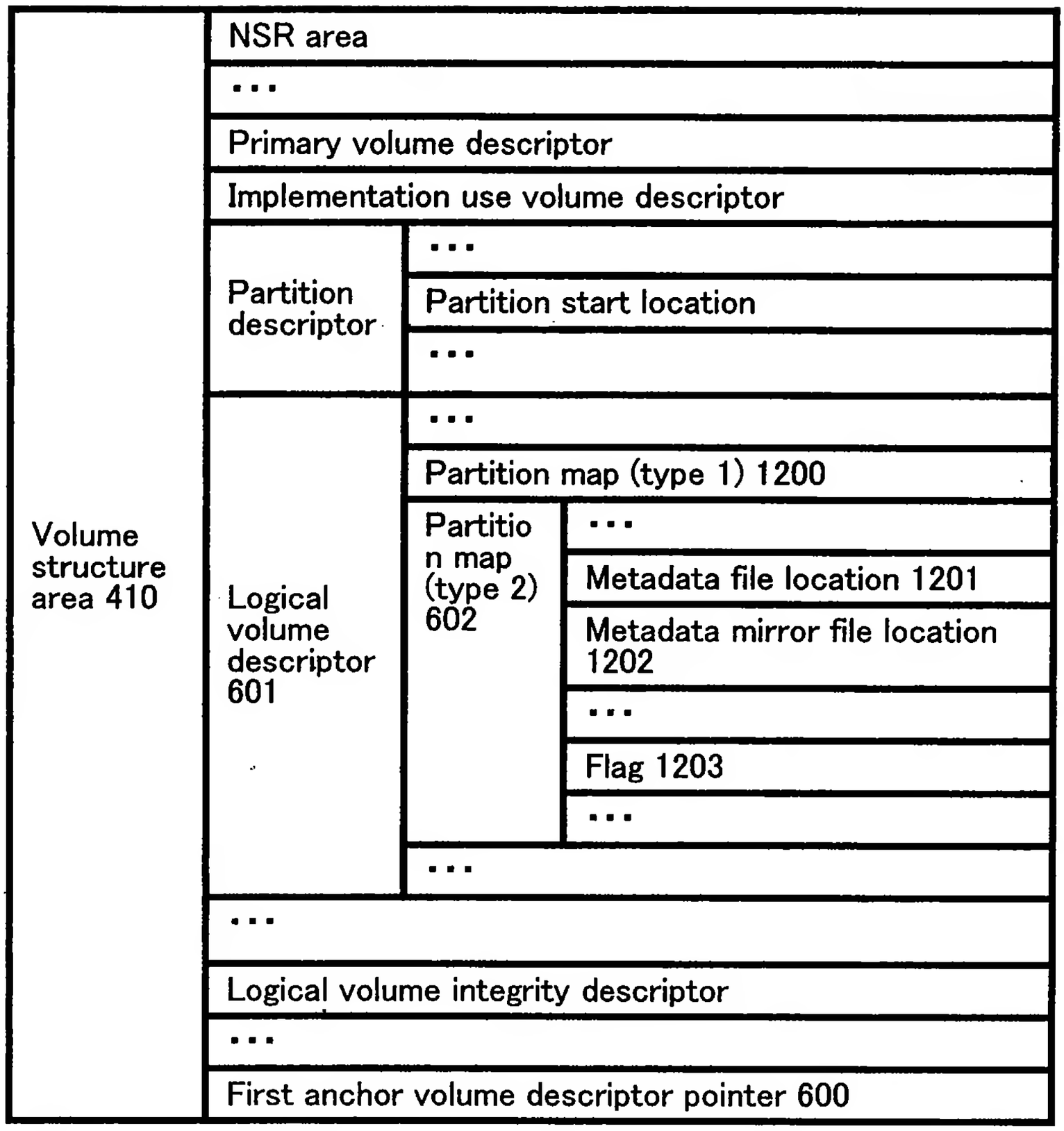


FIG.22

(a)


Volume structure area 410
NSR area
...
Primary volume descriptor
Implementation use volume descriptor
Partition descriptor
...
Partition start location
...
Logical volume descriptor 601
...
Partition map (type 1) 1200
Partition map (type 2) 602
...
Metadata file location 1201
Metadata mirror file location 1202
...
Flag 1203
...
...
...
Logical volume integrity descriptor
...
First anchor volume descriptor pointer 600

(b)

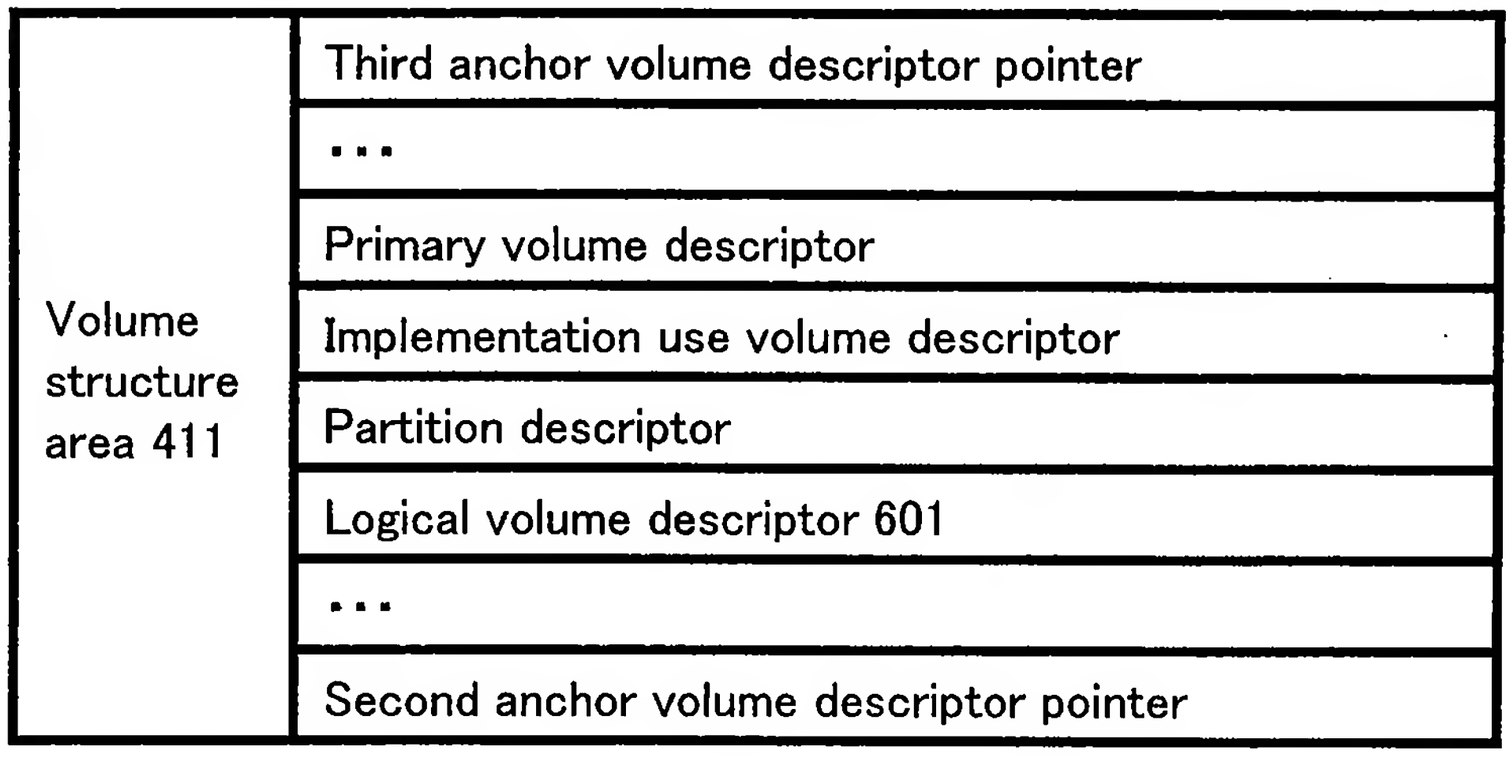
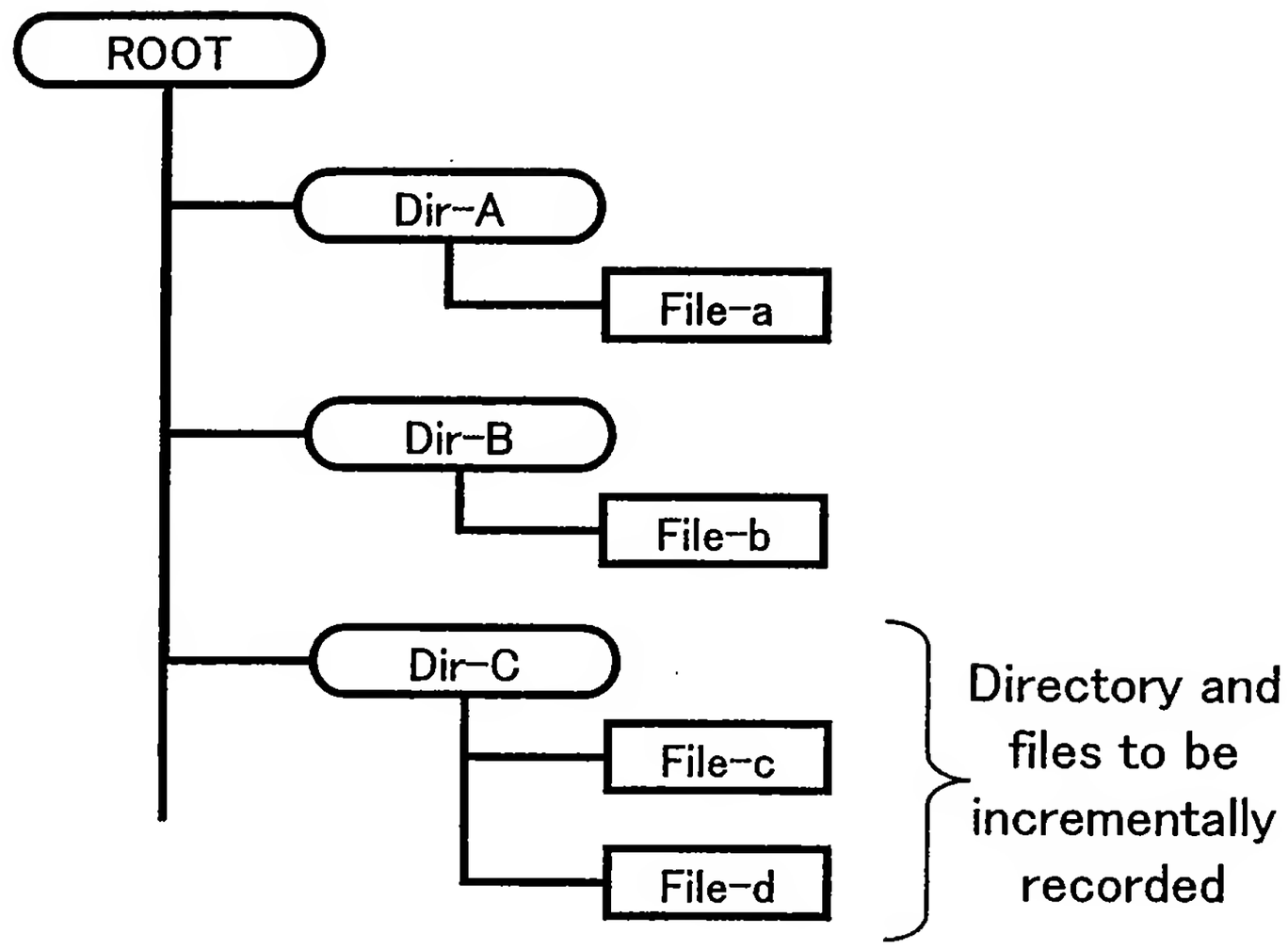

Volume structure area 411
Third anchor volume descriptor pointer
...
Primary volume descriptor
Implementation use volume descriptor
Partition descriptor
Logical volume descriptor 601
...
Second anchor volume descriptor pointer

FIG.23

(a)



(b)

650

FE (Metadata file) 621	
Metadata file 620	File set descriptor 433
	FE(ROOT)442
	FE(Dir−A)443
	FE(Dir−b)444
	FE(Dir−C)622
	FE(File−a)445
	FE(File−b)445
	FE(File−c)623
	FE(File−d)624
Data file (file-c) 630	
Data file (file-d) 631	
FE (Metadata mirror file) 612	
Metadata mirror file 613	(Duplication of Metadata file 620)

FIG.24

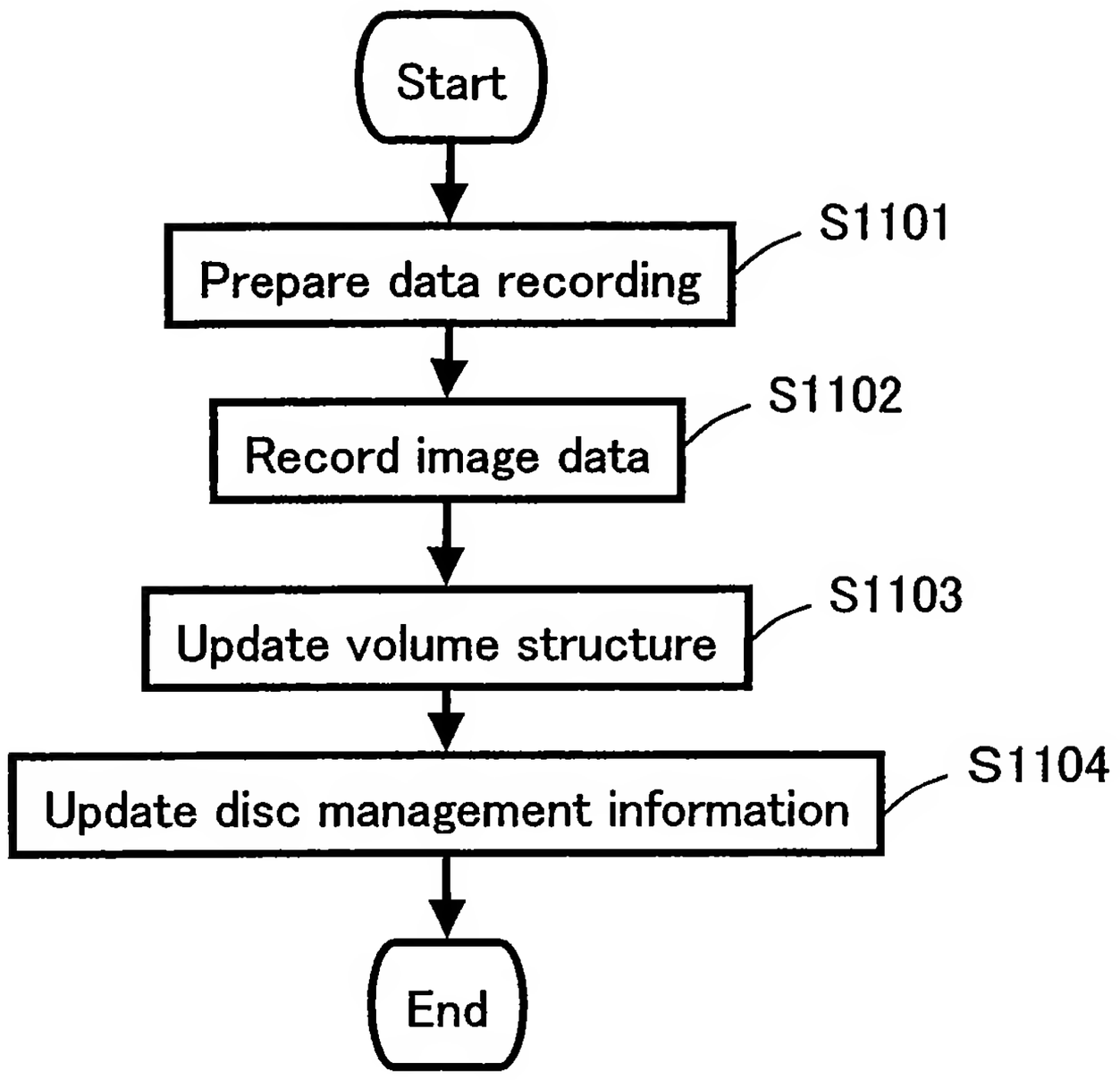

Start
Prepare data recording
S1101
Record image data
S1102
Update volume structure
S1103
Update disc management information
S1104
End

FIG.25

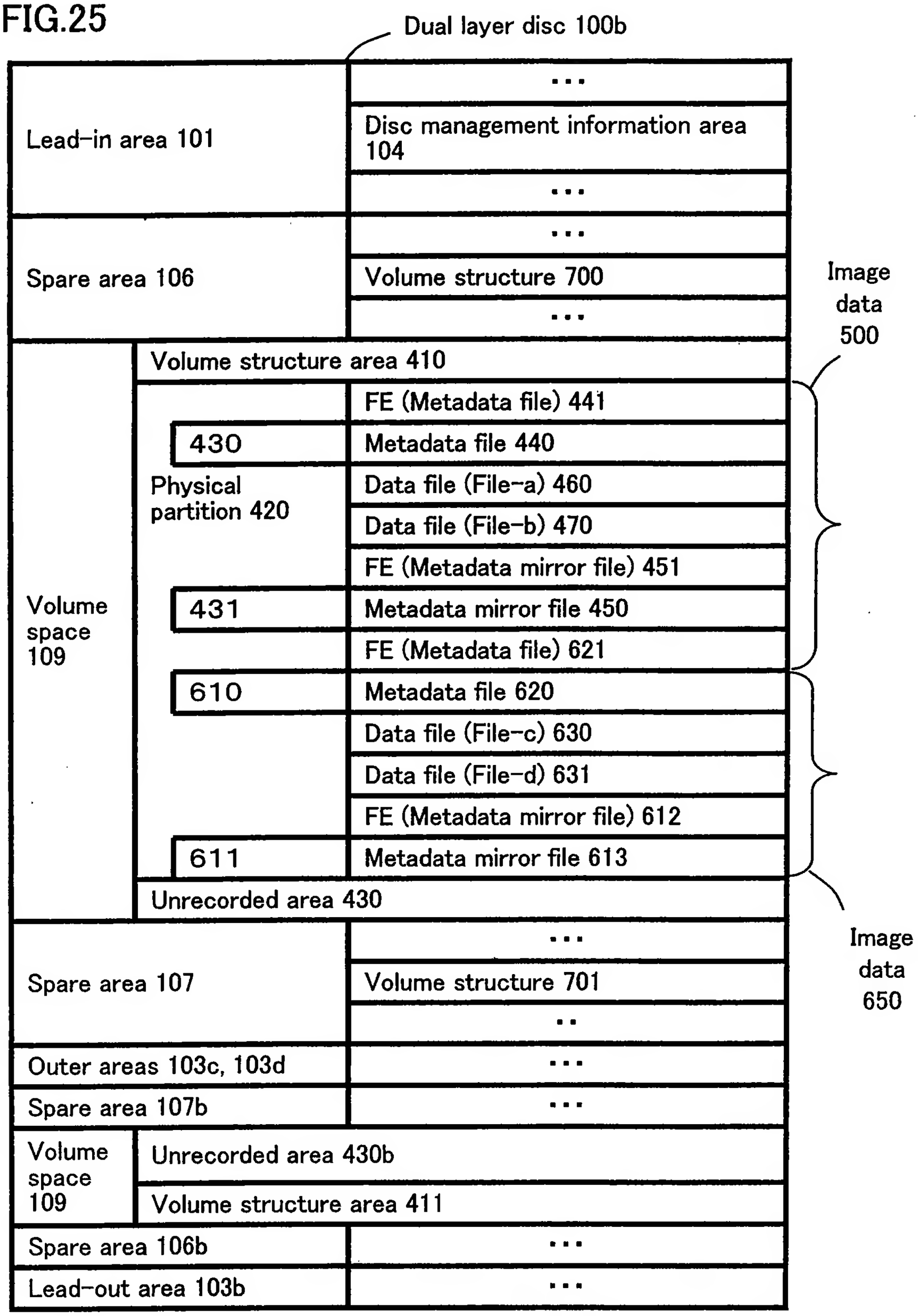

Dual layer disc 100b
Lead-in area 101
Disc management information area 104
Spare area 106
Volume structure 700
Image data 500
Volume space 109
Volume structure area 410
FE (Metadata file) 441
430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
431
Metadata mirror file 450
FE (Metadata file) 621
610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
FE (Metadata mirror file) 612
611
Metadata mirror file 613
Unrecorded area 430
Spare area 107
Volume structure 701
Image data 650
Outer areas 103c, 103d
Spare area 107b
Volume space 109
Unrecorded area 430b
Volume structure area 411
Spare area 106b
Lead-out area 103b

FIG.26

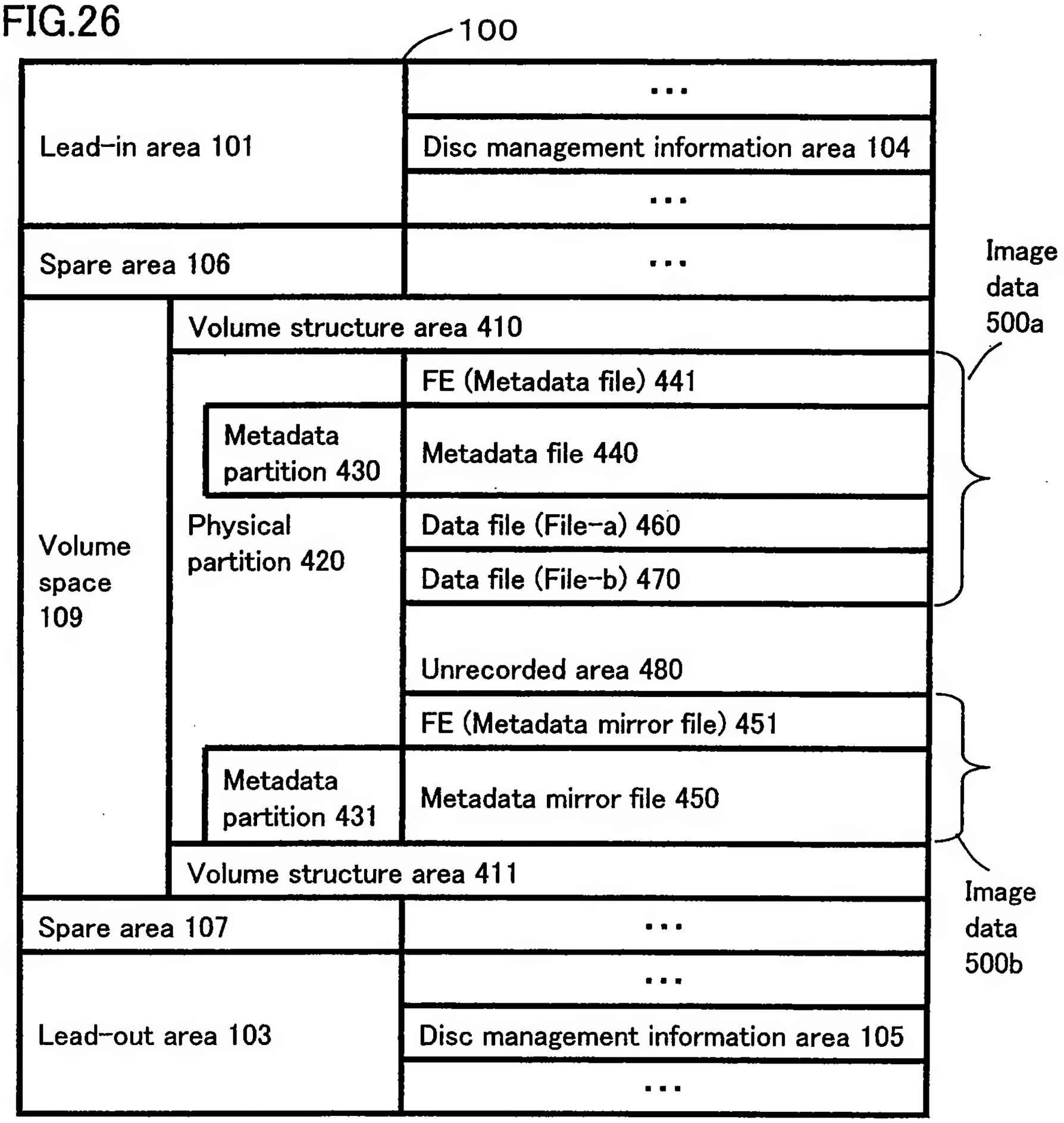

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
Unrecorded area 480
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Volume structure area 411
Image data 500a
Image data 500b
Spare area 107
...
Lead-out area 103
...
Disc management information area 105
...

FIG.27

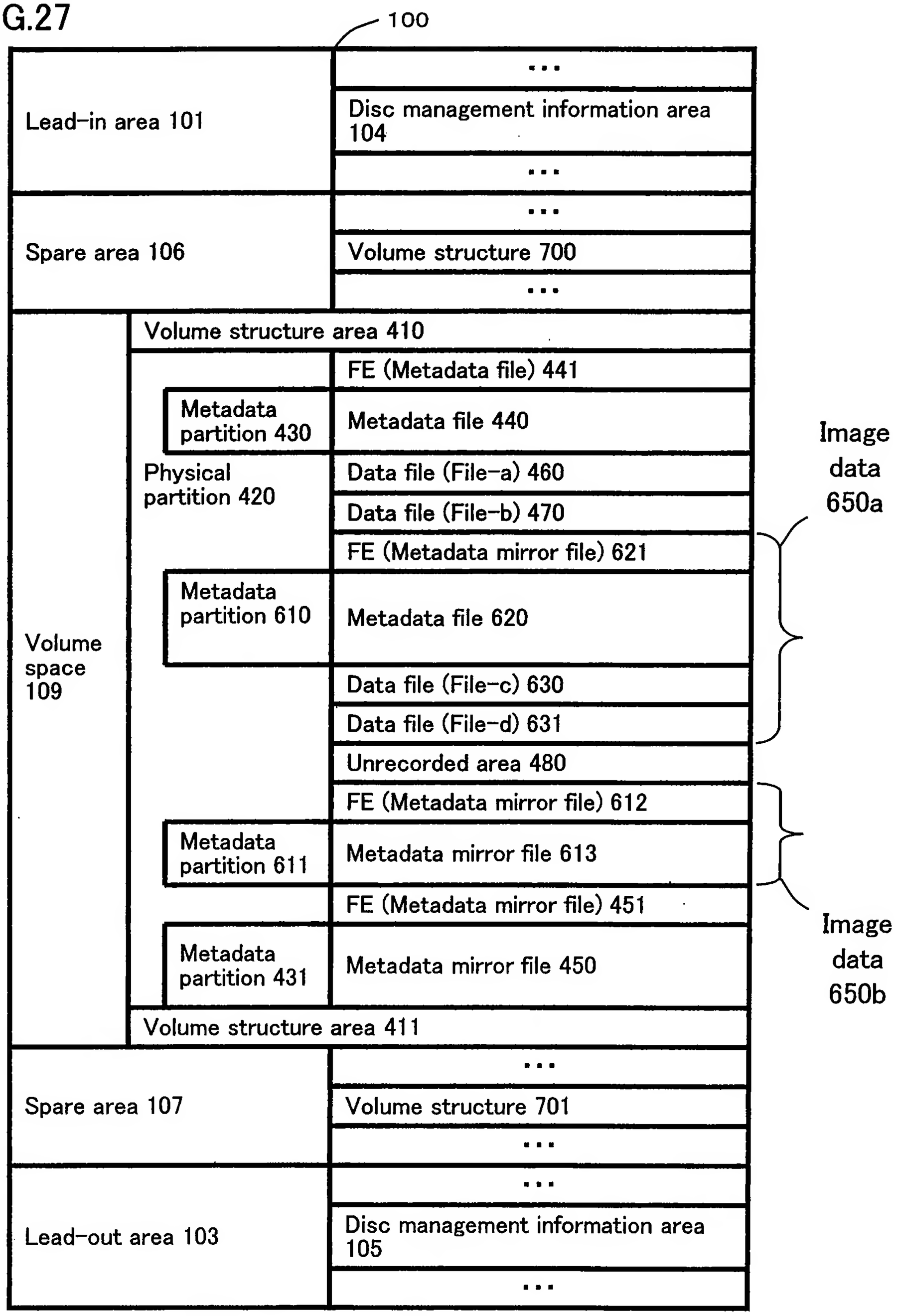

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume structure 700
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 621
Metadata partition 610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
Unrecorded area 480
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Volume structure area 411
Image data 650a
Image data 650b
Spare area 107
...
Volume structure 701
...
Lead-out area 103
...
Disc management information area 105
...

Fig. 28

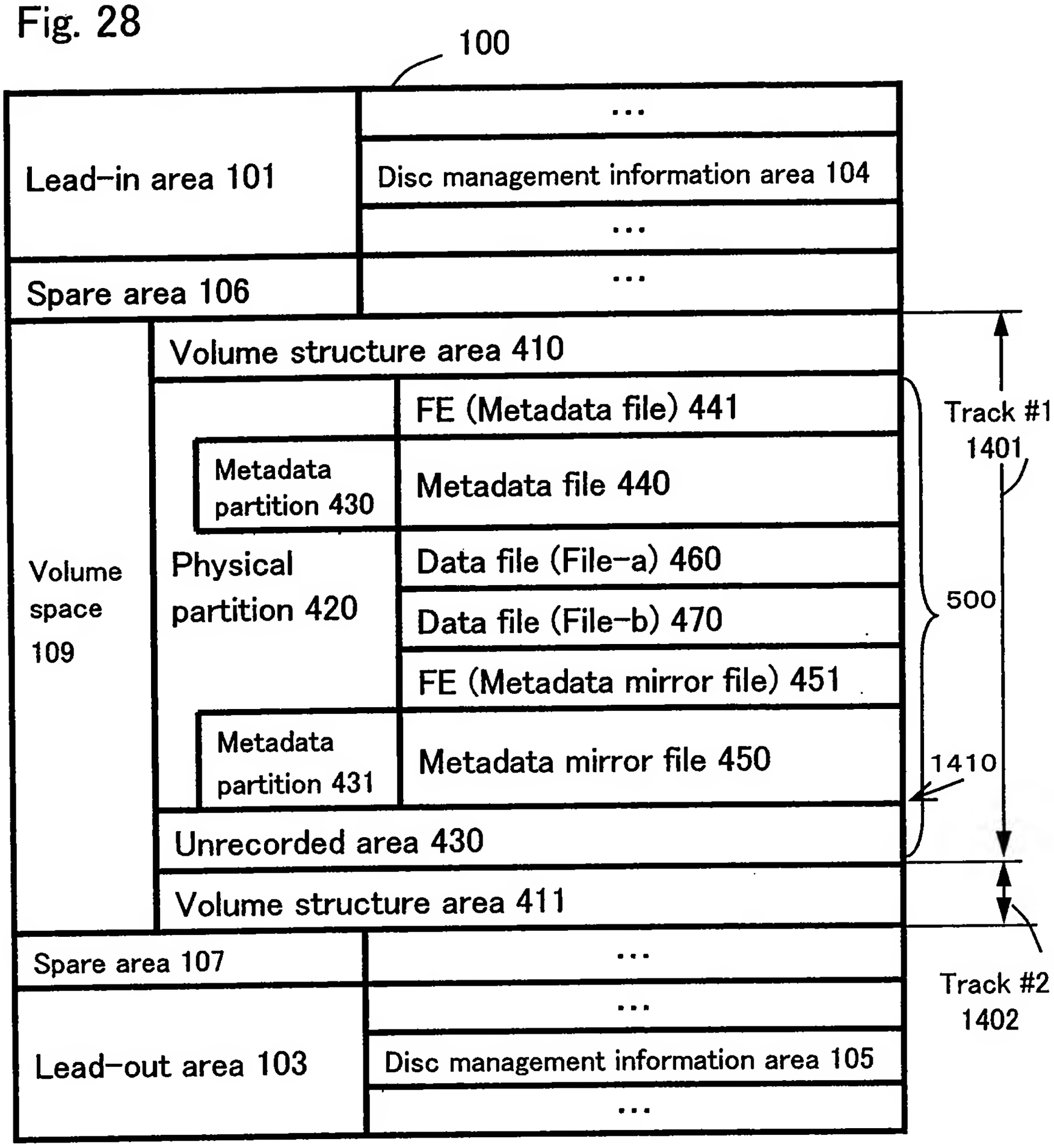

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Unrecorded area 430
Volume structure area 411
Spare area 107
...
...
Lead-out area 103
Disc management information area 105
...
Track #1
1401
500
1410
Track #2
1402

Fig. 29

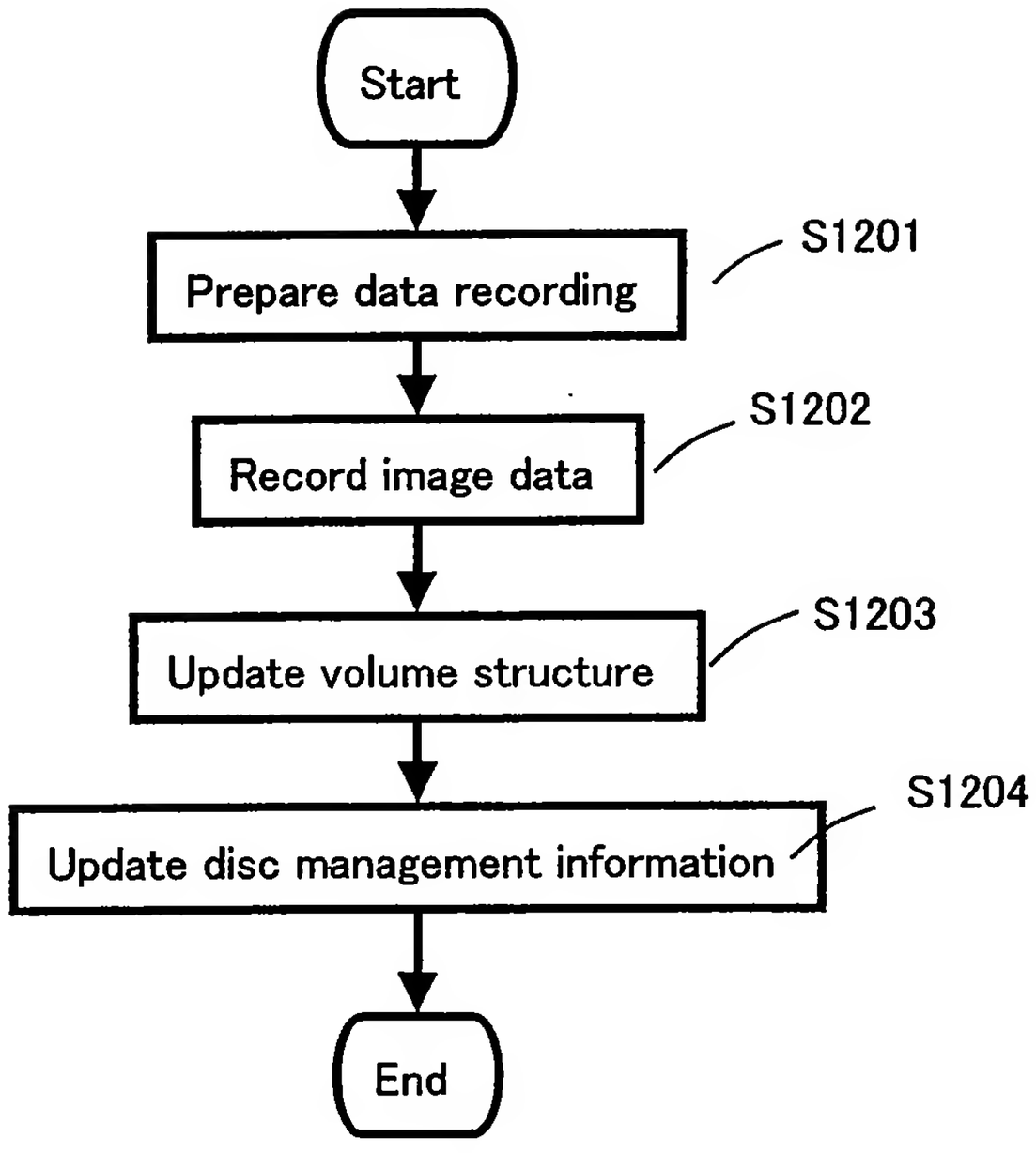

Start
Prepare data recording
S1201
Record image data
S1202
Update volume structure
S1203
Update disc management information
S1204
End

Fig. 30

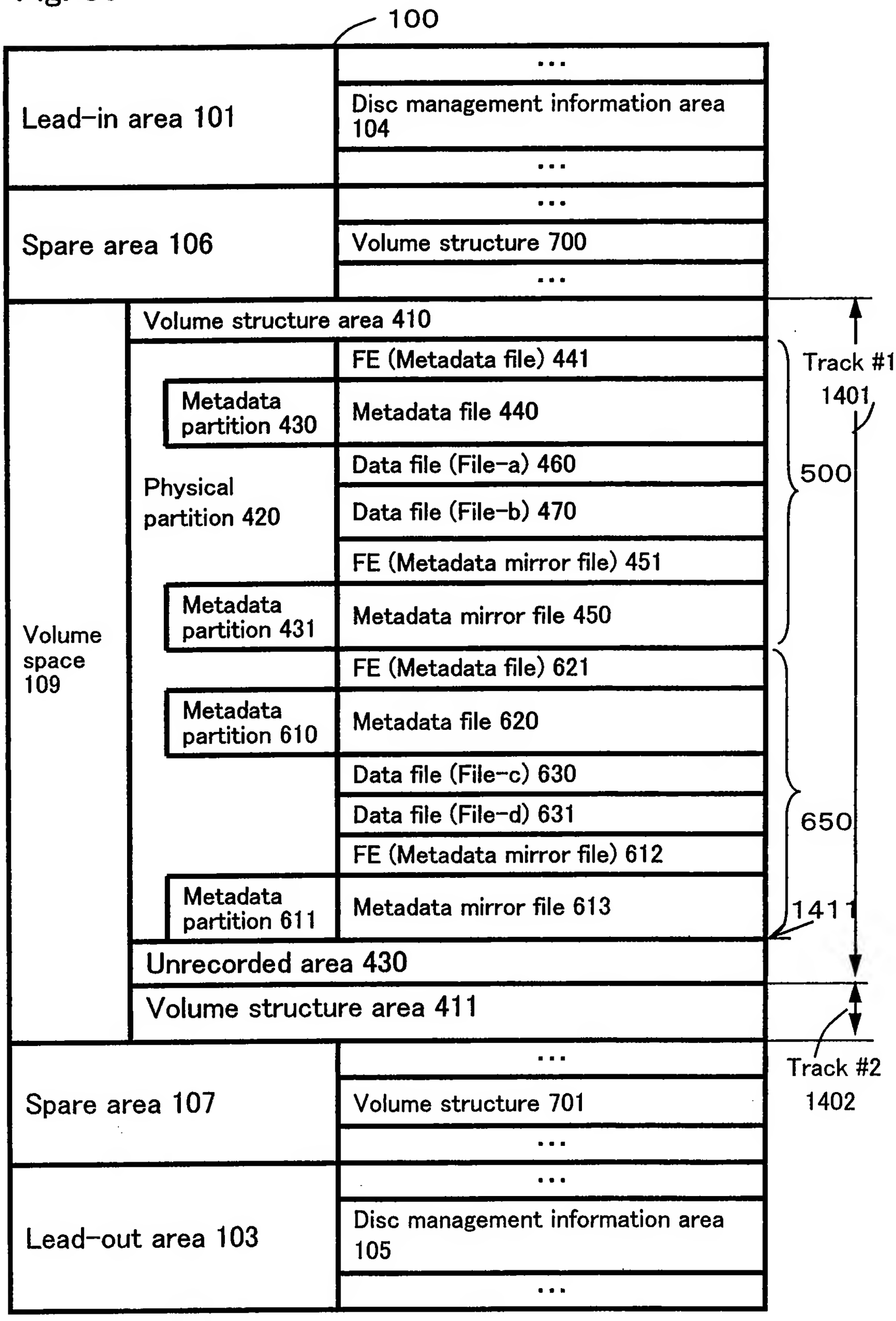

100
Lead-in area 101
...
Disc management information area 104
...
...
Spare area 106
Volume structure 700
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
FE (Metadata file) 621
Metadata partition 610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
Unrecorded area 430
Volume structure area 411
Track #1
1401
500
650
1411
Track #2
1402
...
Spare area 107
Volume structure 701
...
...
Lead-out area 103
Disc management information area 105
...

Fig. 31

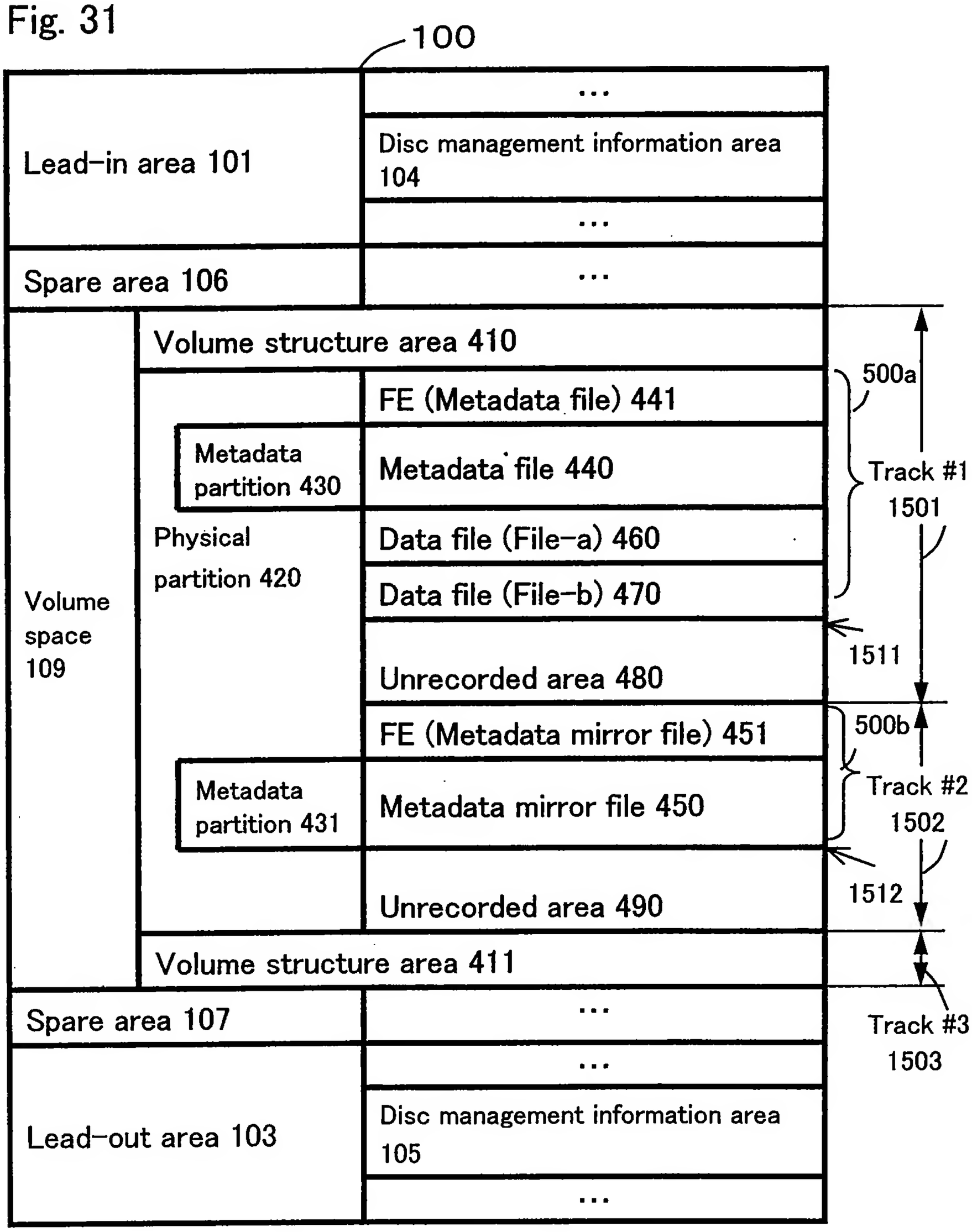

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume space 109
Volume structure area 410
Physical partition 420
Metadata partition 430
FE (Metadata file) 441
Metadata file 440
Data file (File-a) 460
Data file (File-b) 470
Unrecorded area 480
Metadata partition 431
FE (Metadata mirror file) 451
Metadata mirror file 450
Unrecorded area 490
Volume structure area 411
500a
Track #1
1501
1511
500b
Track #2
1502
1512
Track #3
1503
Spare area 107
...
Lead-out area 103
...
Disc management information area 105
...

Fig. 32

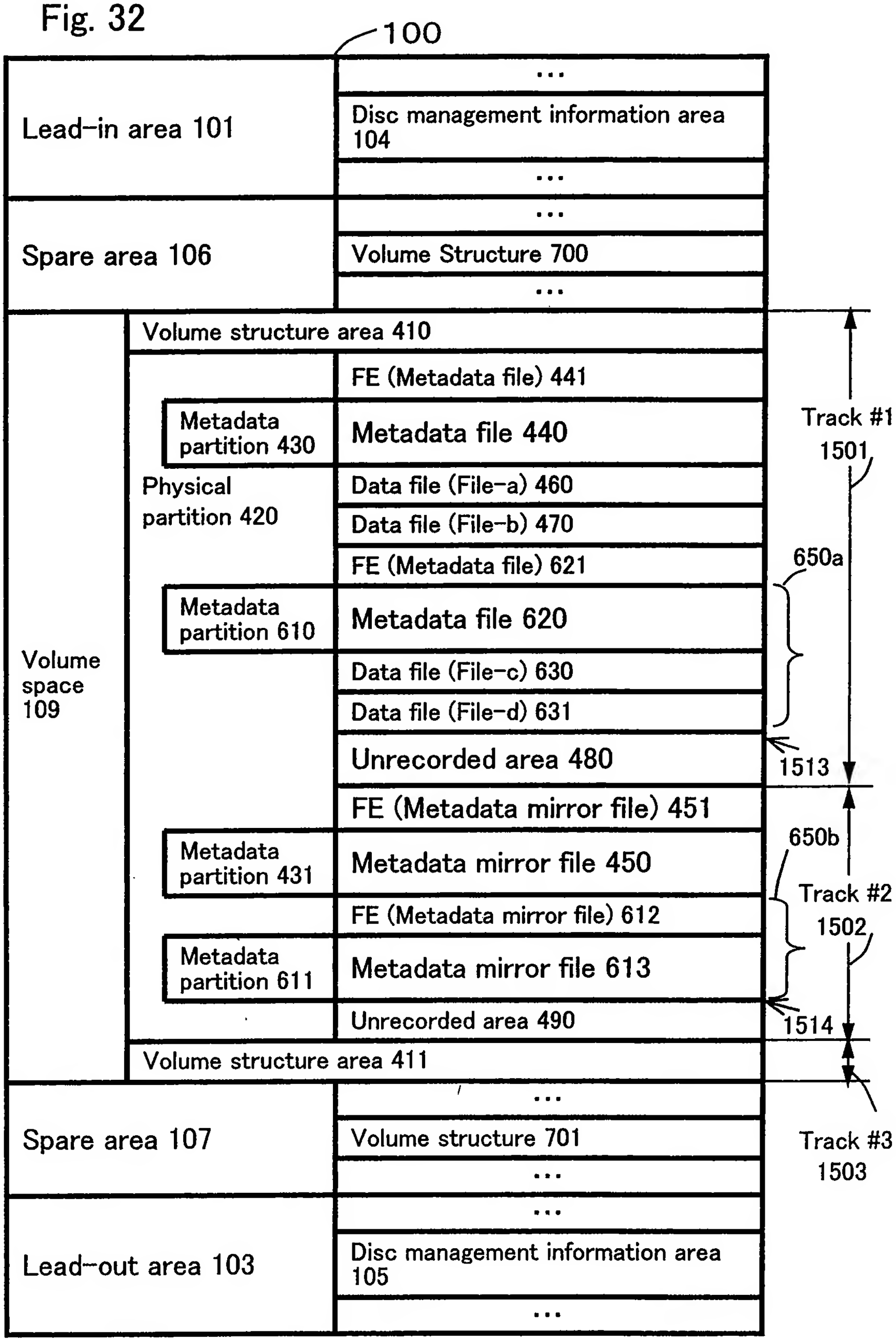

100
Lead-in area 101
...
Disc management information area 104
...
...
Spare area 106
Volume Structure 700
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata file) 621
Metadata partition 610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
Unrecorded area 480
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
FE (Metadata mirror file) 612
Metadata partition 611
Metadata mirror file 613
Unrecorded area 490
Volume structure area 411
Track #1
1501
650a
1513
650b
Track #2
1502
1514
Track #3
1503
Spare area 107
...
Volume structure 701
...
...
Lead-out area 103
Disc management information area 105
...

Fig. 33

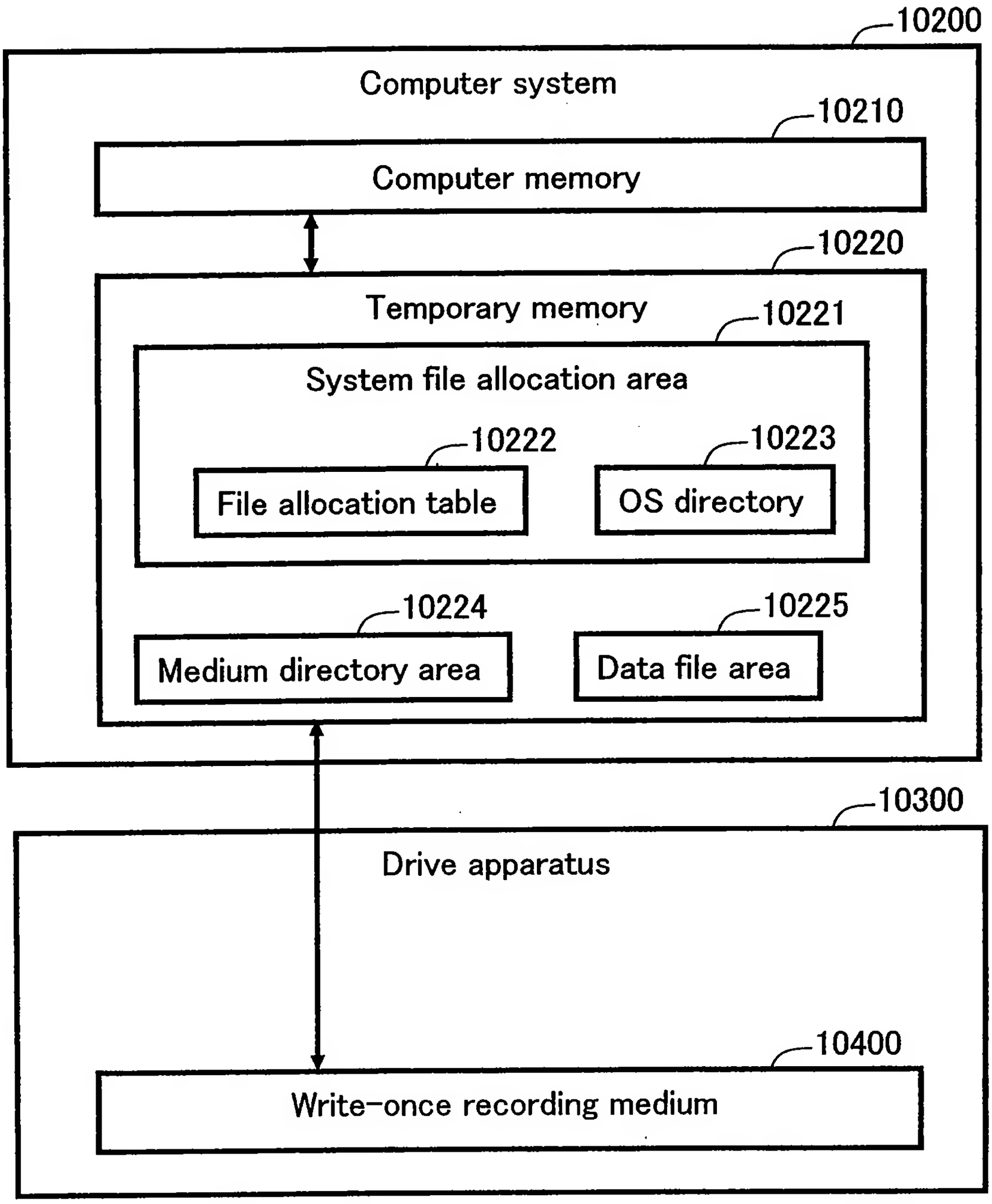

10200
Computer system
10210
Computer memory
10220
Temporary memory
10221
System file allocation area
10222
File allocation table
10223
OS directory
10224
Medium directory area
10225
Data file area
10300
Drive apparatus
10400
Write-once recording medium

Fig. 34

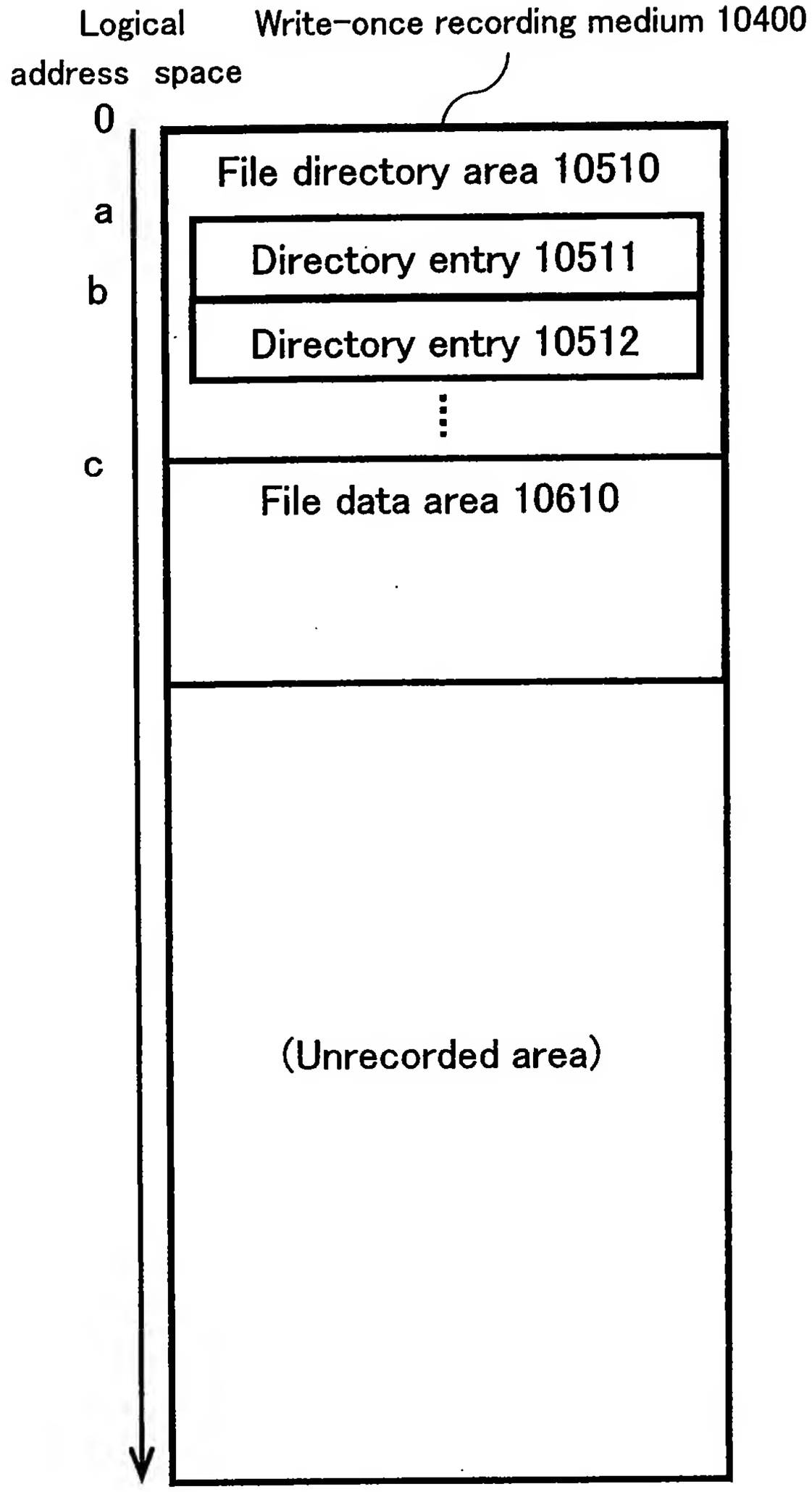

Logical address space
Write-once recording medium 10400
0
a
b
c
File directory area 10510
Directory entry 10511
Directory entry 10512
File data area 10610
(Unrecorded area)

Fig. 35

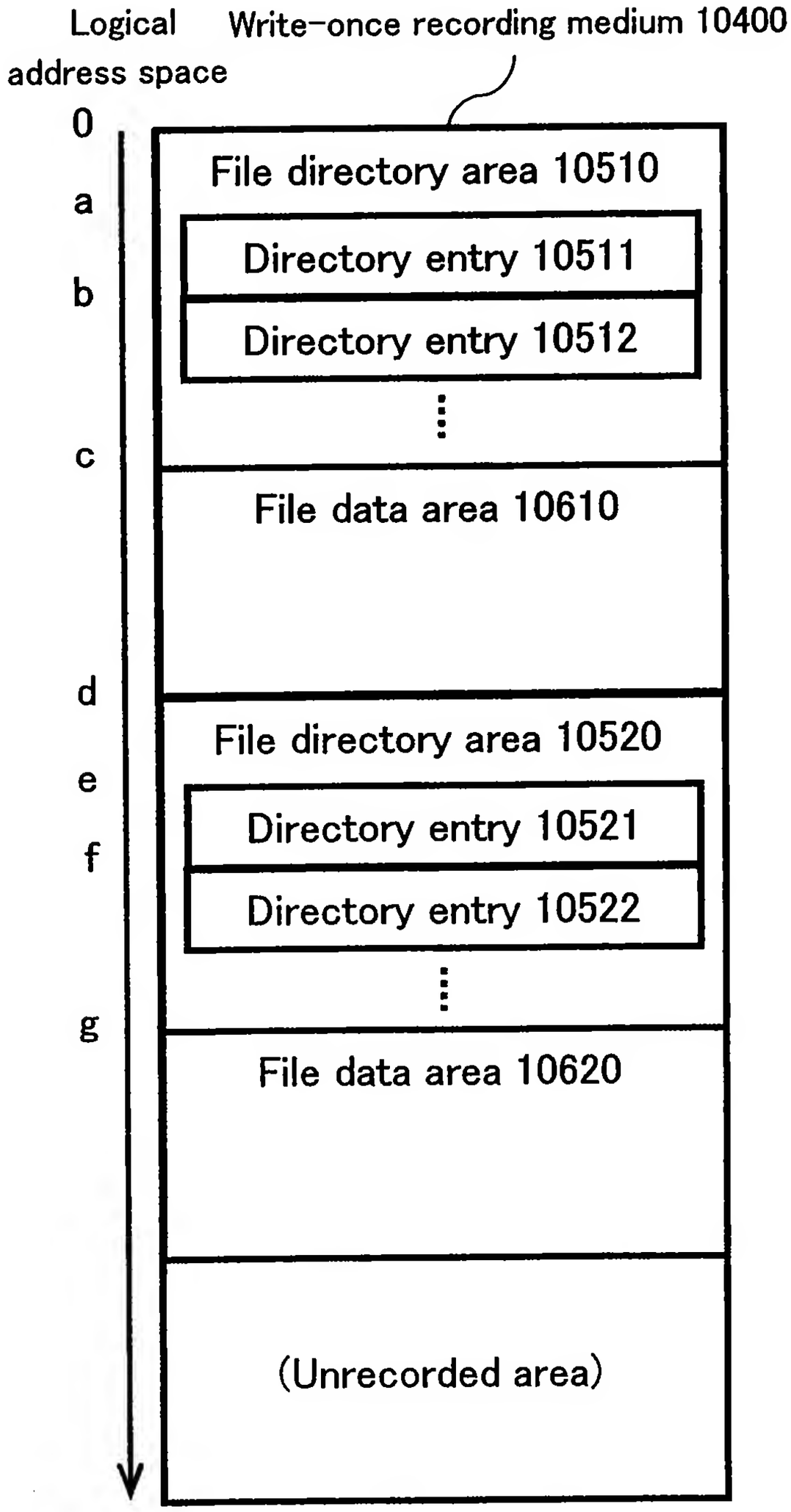
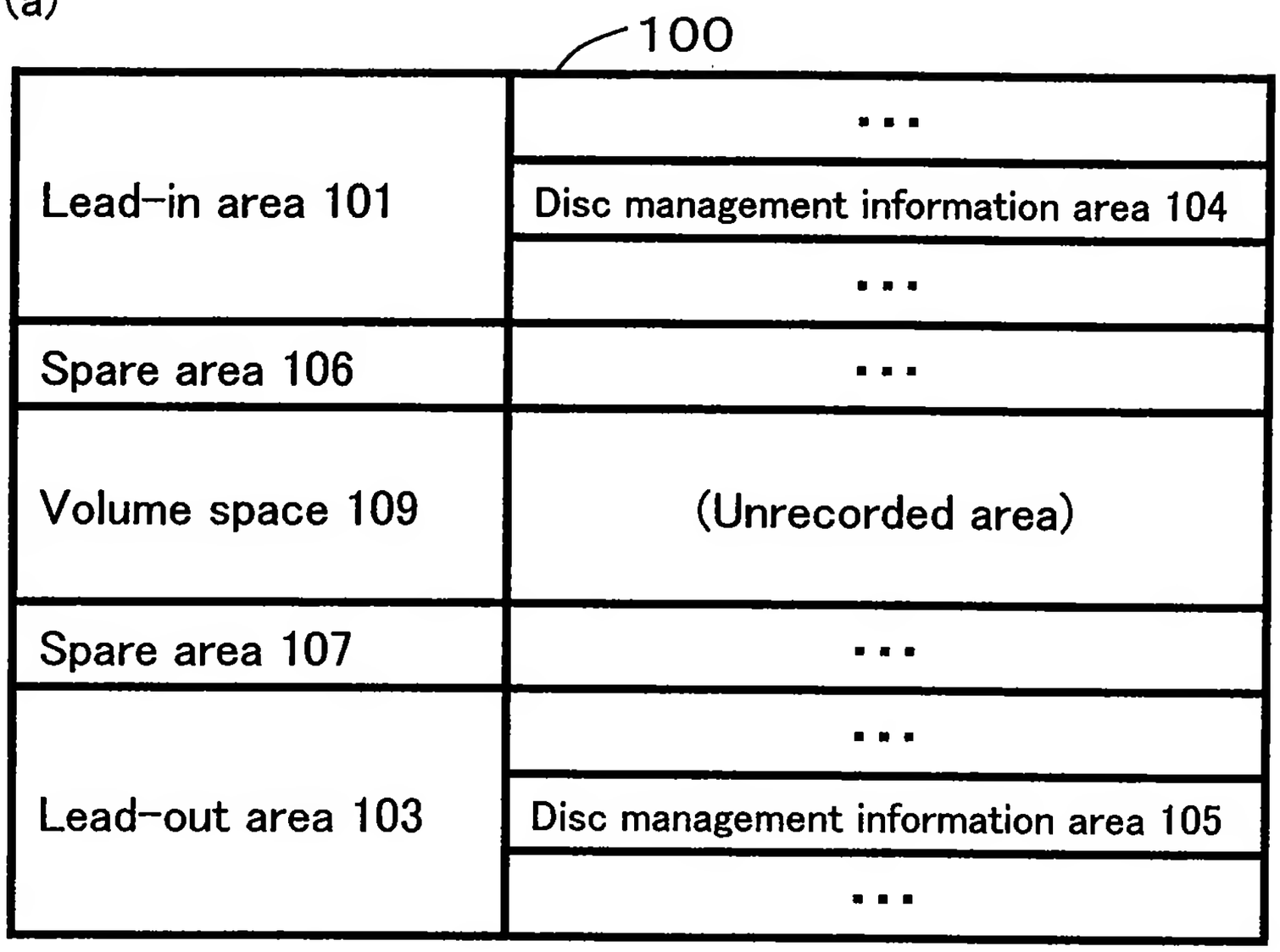

Logical address space
Write-once recording medium 10400
0
a
b
c
d
e
f
g
File directory area 10510
Directory entry 10511
Directory entry 10512
File data area 10610
File directory area 10520
Directory entry 10521
Directory entry 10522
File data area 10620
(Unrecorded area)

Fig. 36

(a)


100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume space 109
(Unrecorded area)
Spare area 107
...
...
Lead-out area 103
Disc management information area 105
...

(b)

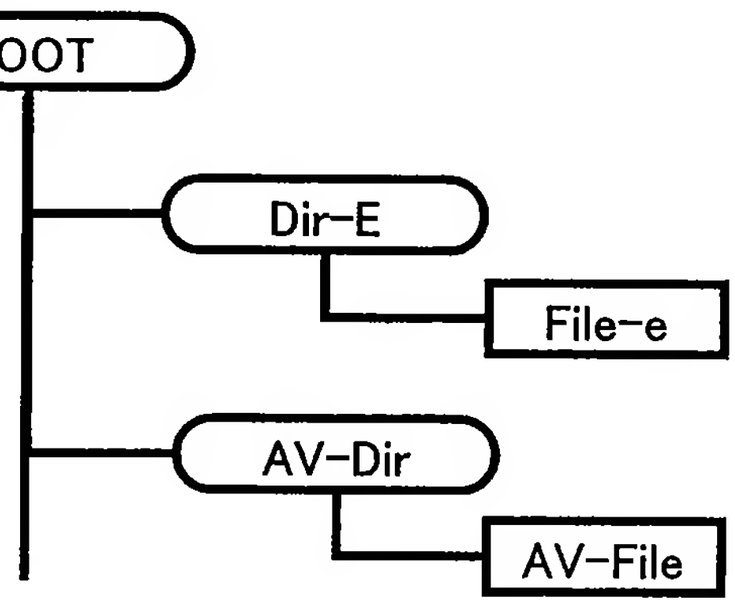

ROOT
Dir-E
File-e
AV-Dir
AV-File

Fig. 37

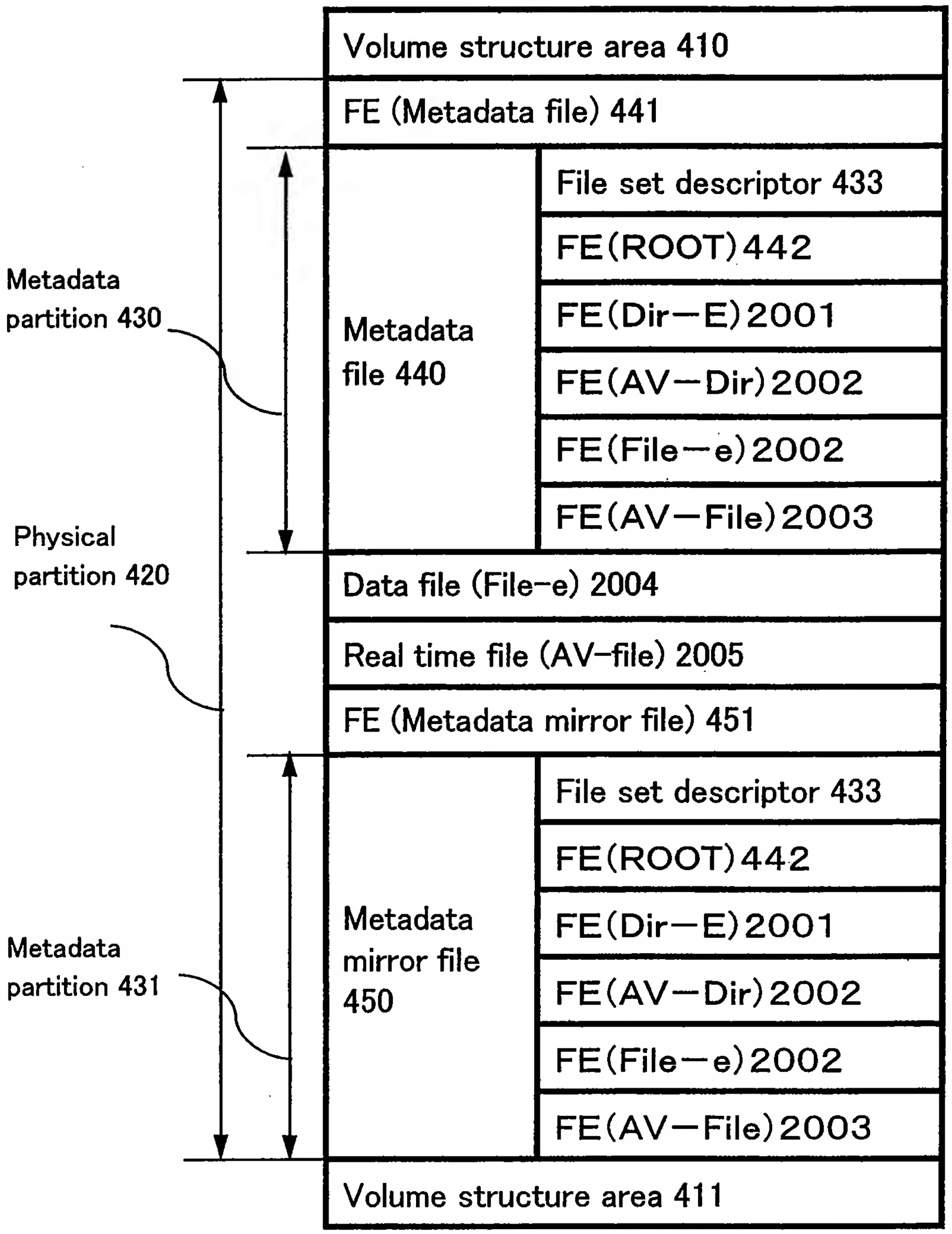

Volume structure area 410
FE (Metadata file) 441
File set descriptor 433
FE(ROOT)442
FE(Dir−E)2001
FE(AV−Dir)2002
FE(File−e)2002
FE(AV−File)2003
Metadata file 440
Metadata partition 430
Physical partition 420
Data file (File-e) 2004
Real time file (AV-file) 2005
FE (Metadata mirror file) 451
File set descriptor 433
FE(ROOT)442
FE(Dir−E)2001
FE(AV−Dir)2002
FE(File−e)2002
FE(AV−File)2003
Metadata mirror file 450
Metadata partition 431
Volume structure area 411

FIG.38

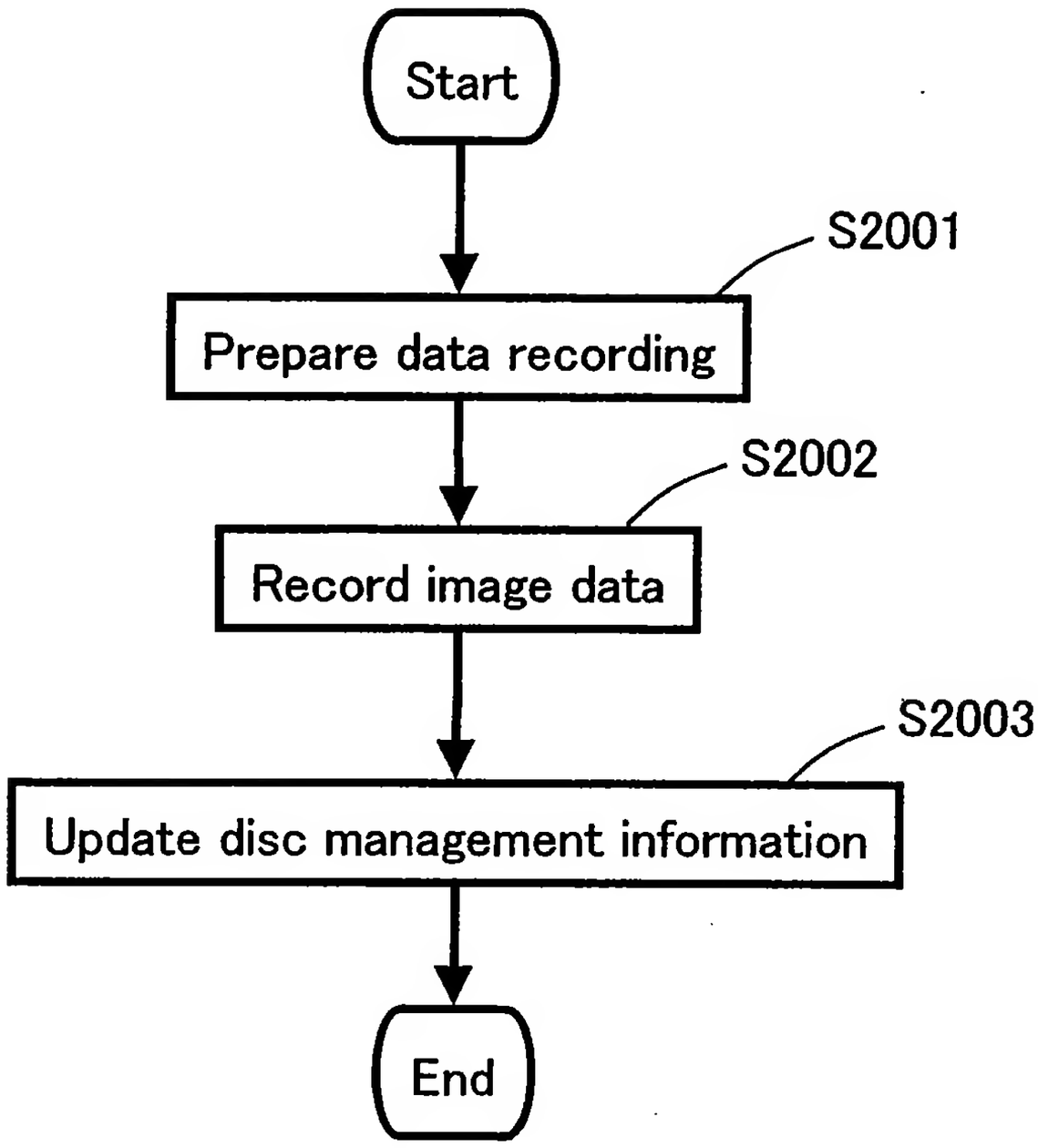

Start
S2001
Prepare data recording
S2002
Record image data
S2003
Update disc management information
End

FIG.39

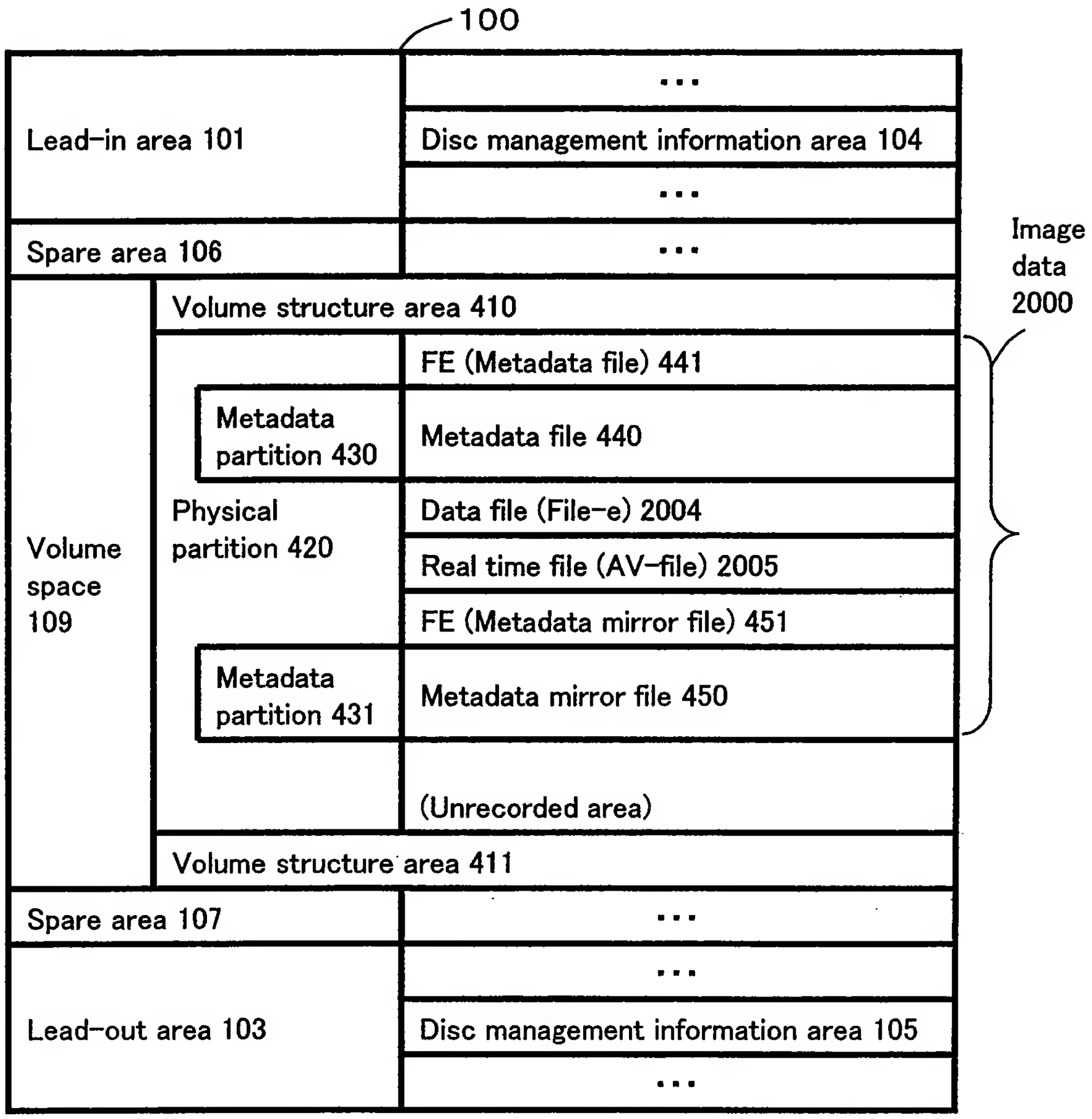

100
Lead-in area 101
...
Disc management information area 104
...
Spare area 106
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-e) 2004
Real time file (AV-file) 2005
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
(Unrecorded area)
Volume structure area 411
Spare area 107
...
Lead-out area 103
...
Disc management information area 105
...
Image data 2000

FIG.40

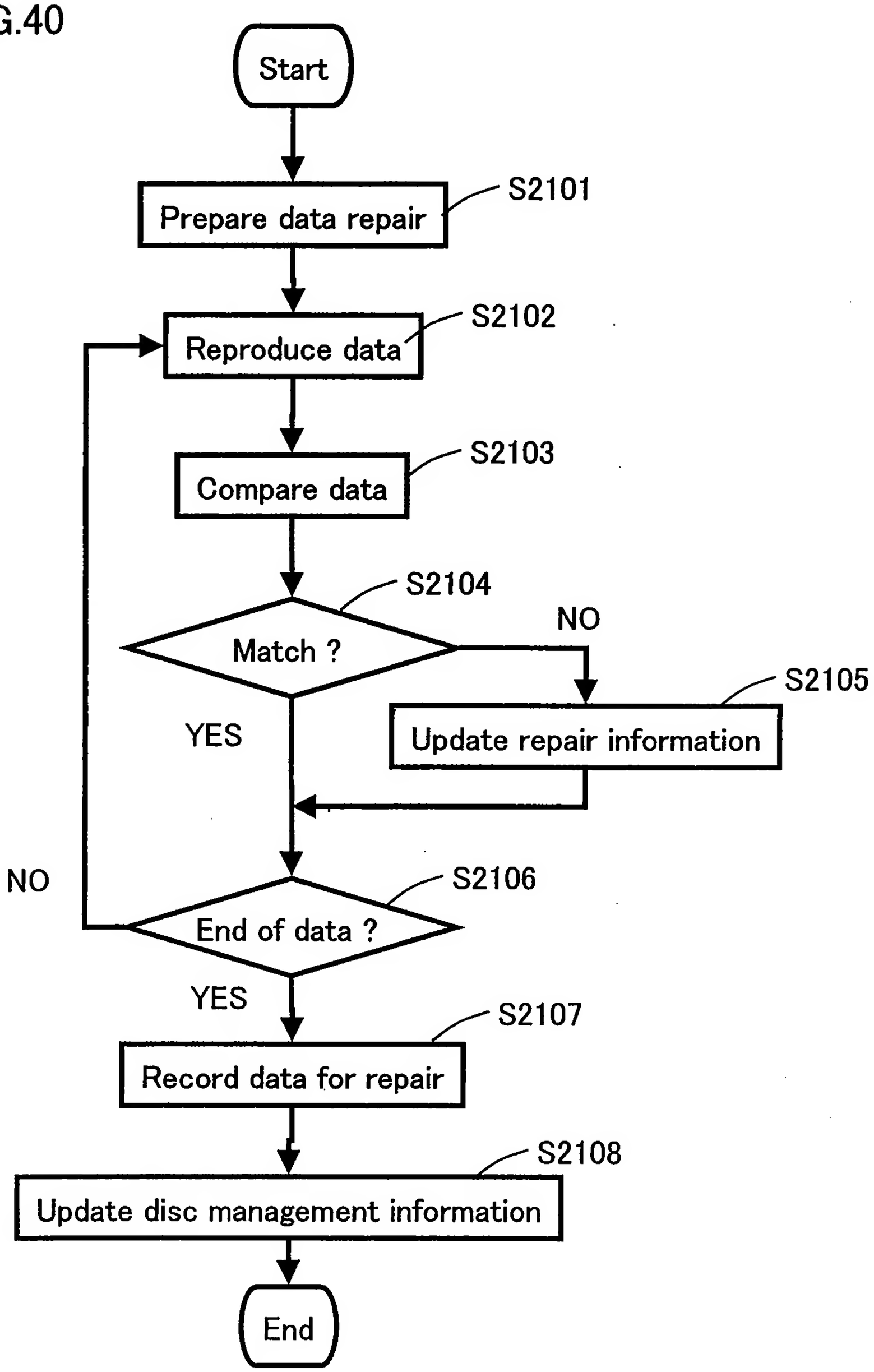

Start
Prepare data repair
S2101
Reproduce data
S2102
Compare data
S2103
Match ?
S2104
NO
Update repair information
S2105
YES
End of data ?
S2106
NO
YES
Record data for repair
S2107
Update disc management information
S2108
End

FIG.41

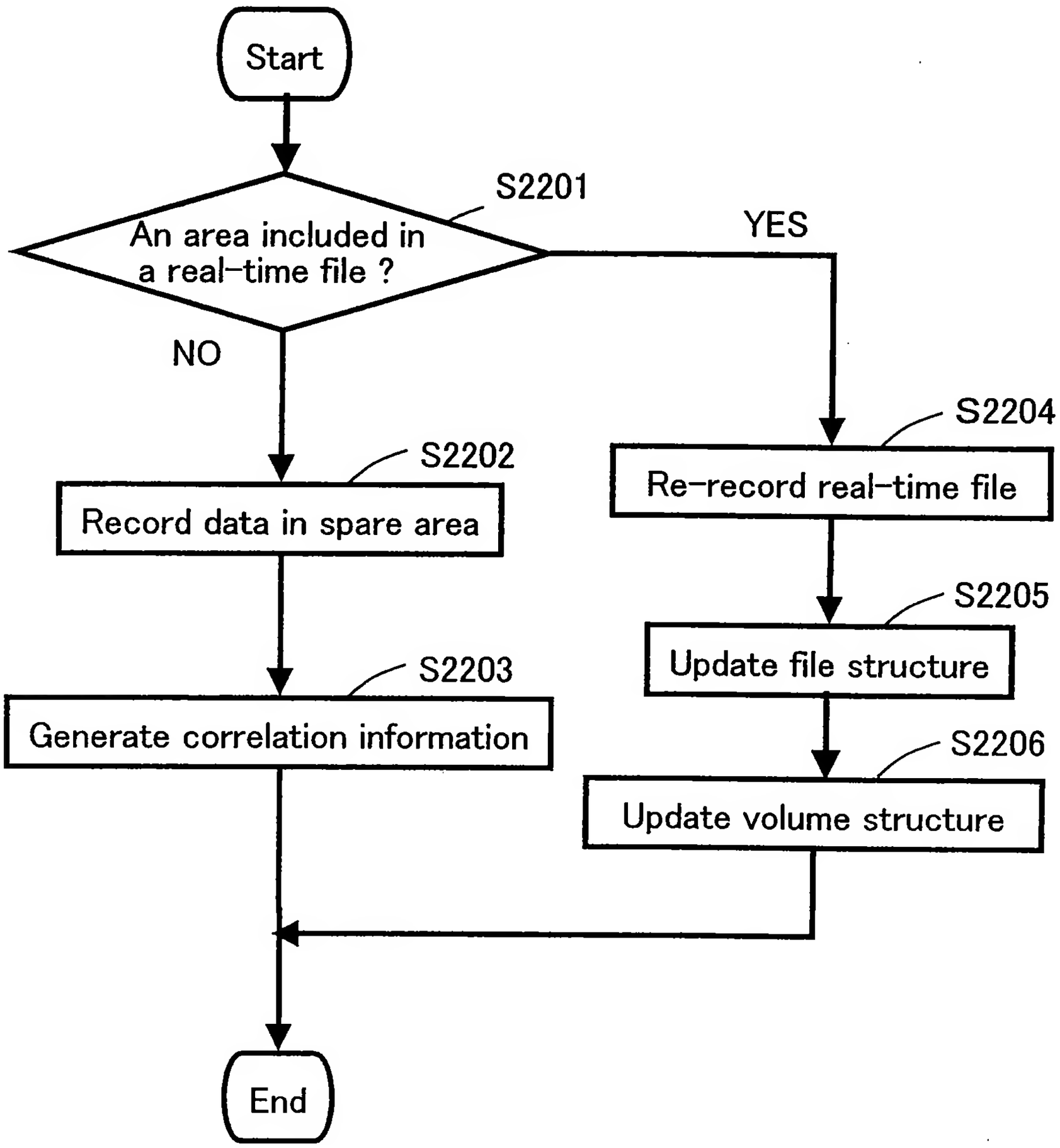

Start
S2201
An area included in a real-time file ?
YES
NO
S2204
Re-record real-time file
S2205
Update file structure
S2206
Update volume structure
S2202
Record data in spare area
S2203
Generate correlation information
End

FIG.42

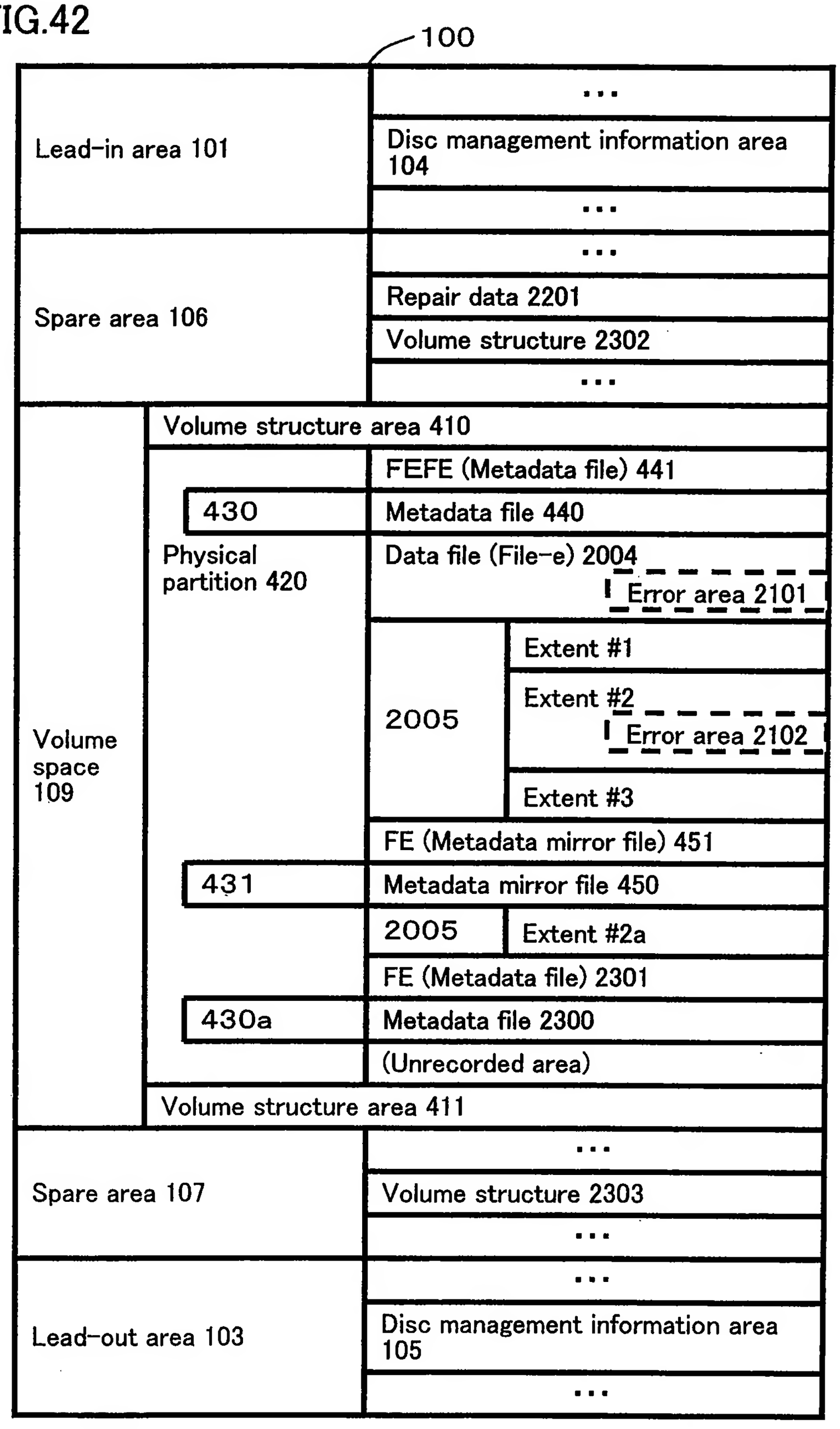

100
Lead-in area 101
...
Disc management information area 104
...
...
Spare area 106
...
Repair data 2201
Volume structure 2302
...
Volume space 109
Volume structure area 410
FEFE (Metadata file) 441
430
Metadata file 440
Physical partition 420
Data file (File-e) 2004
Error area 2101
2005
Extent #1
Extent #2
Error area 2102
Extent #3
FE (Metadata mirror file) 451
431
Metadata mirror file 450
2005
Extent #2a
FE (Metadata file) 2301
430a
Metadata file 2300
(Unrecorded area)
Volume structure area 411
Spare area 107
...
Volume structure 2303
...
...
Lead-out area 103
Disc management information area 105
...

FIG.43

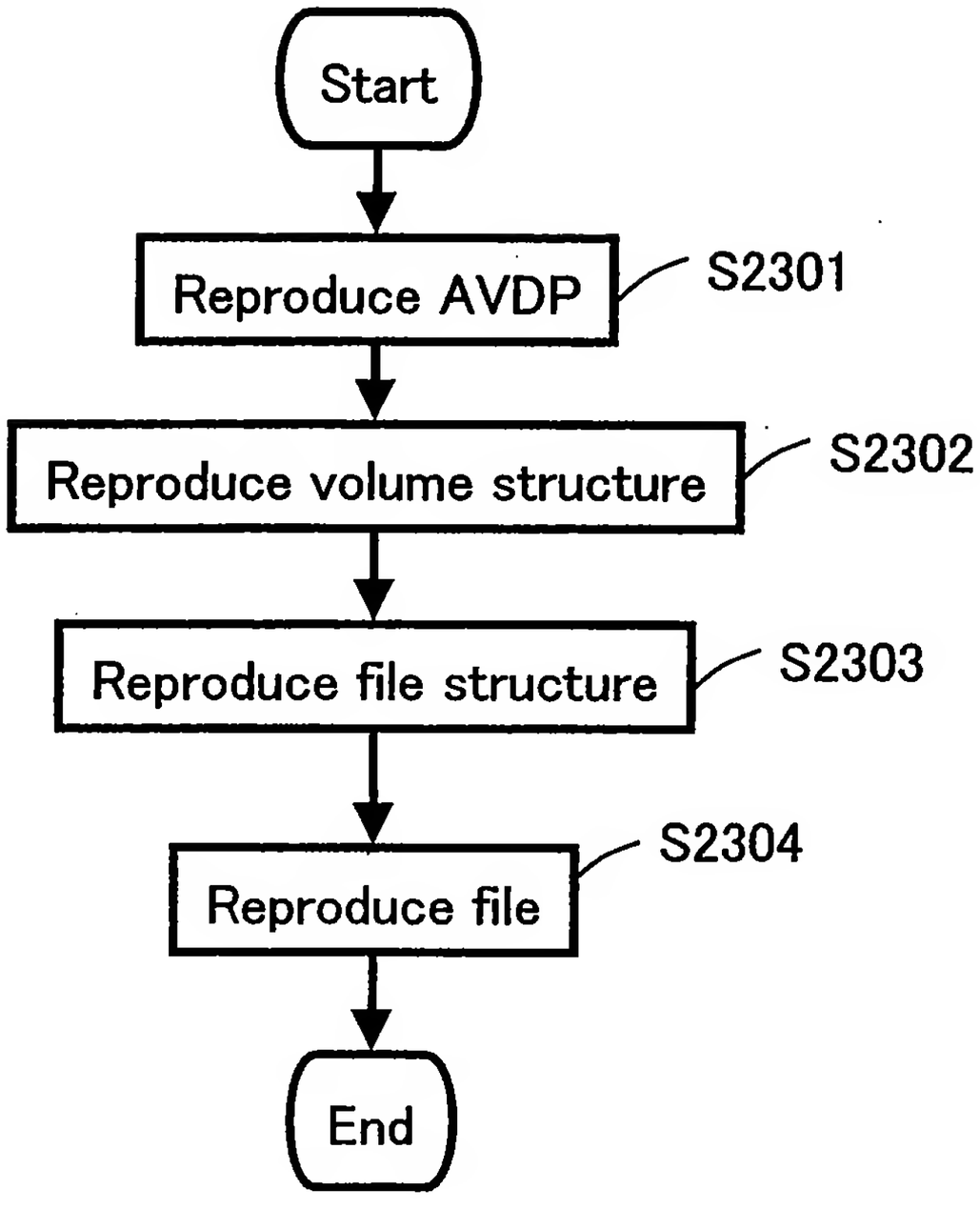

Start
Reproduce AVDP
S2301
Reproduce volume structure
S2302
Reproduce file structure
S2303
Reproduce file
S2304
End

FIG.44

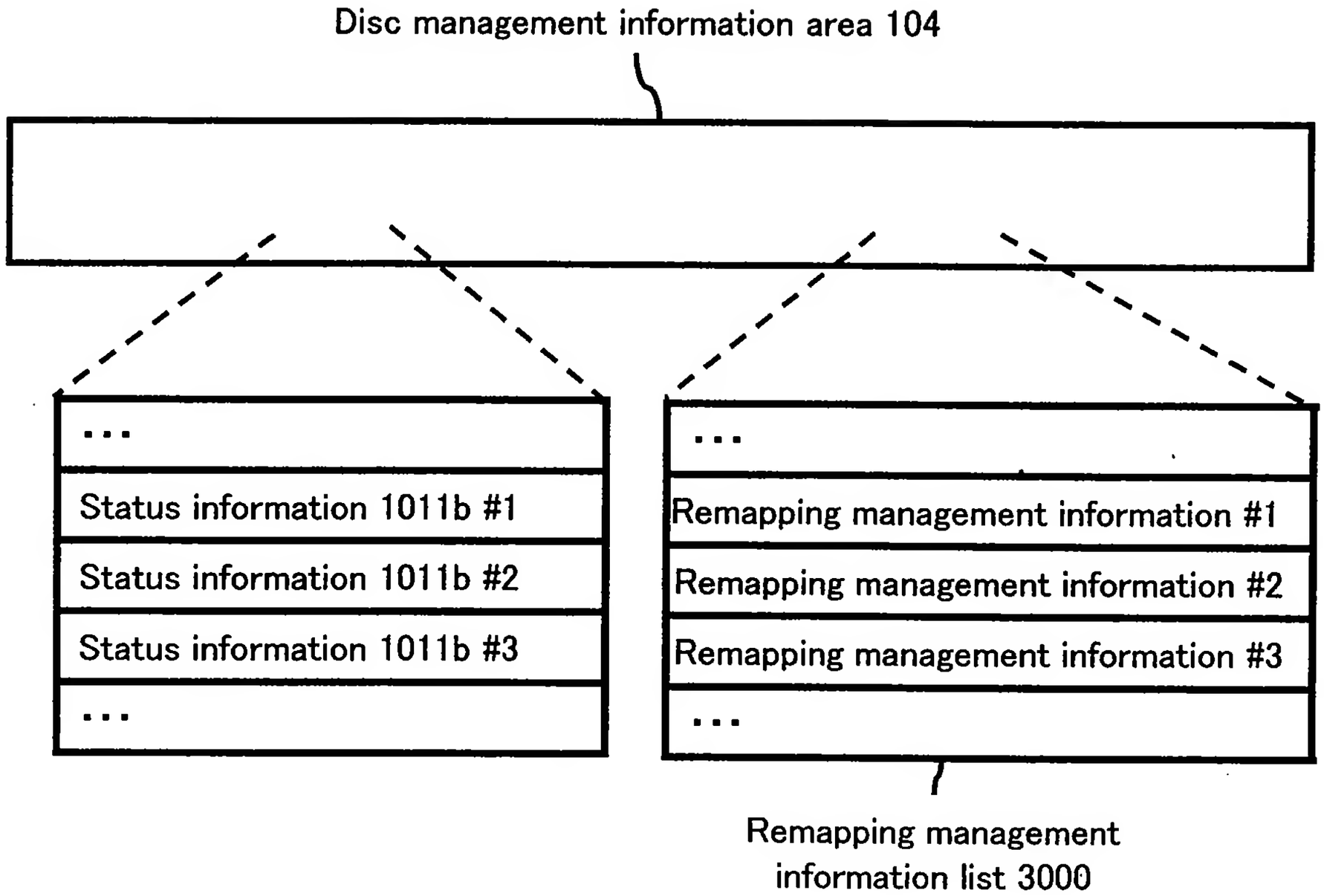

Disc management information area 104
...
Status information 1011b #1
Status information 1011b #2
Status information 1011b #3
...
...
Remapping management information #1
Remapping management information #2
Remapping management information #3
...
Remapping management information list 3000

FIG.45

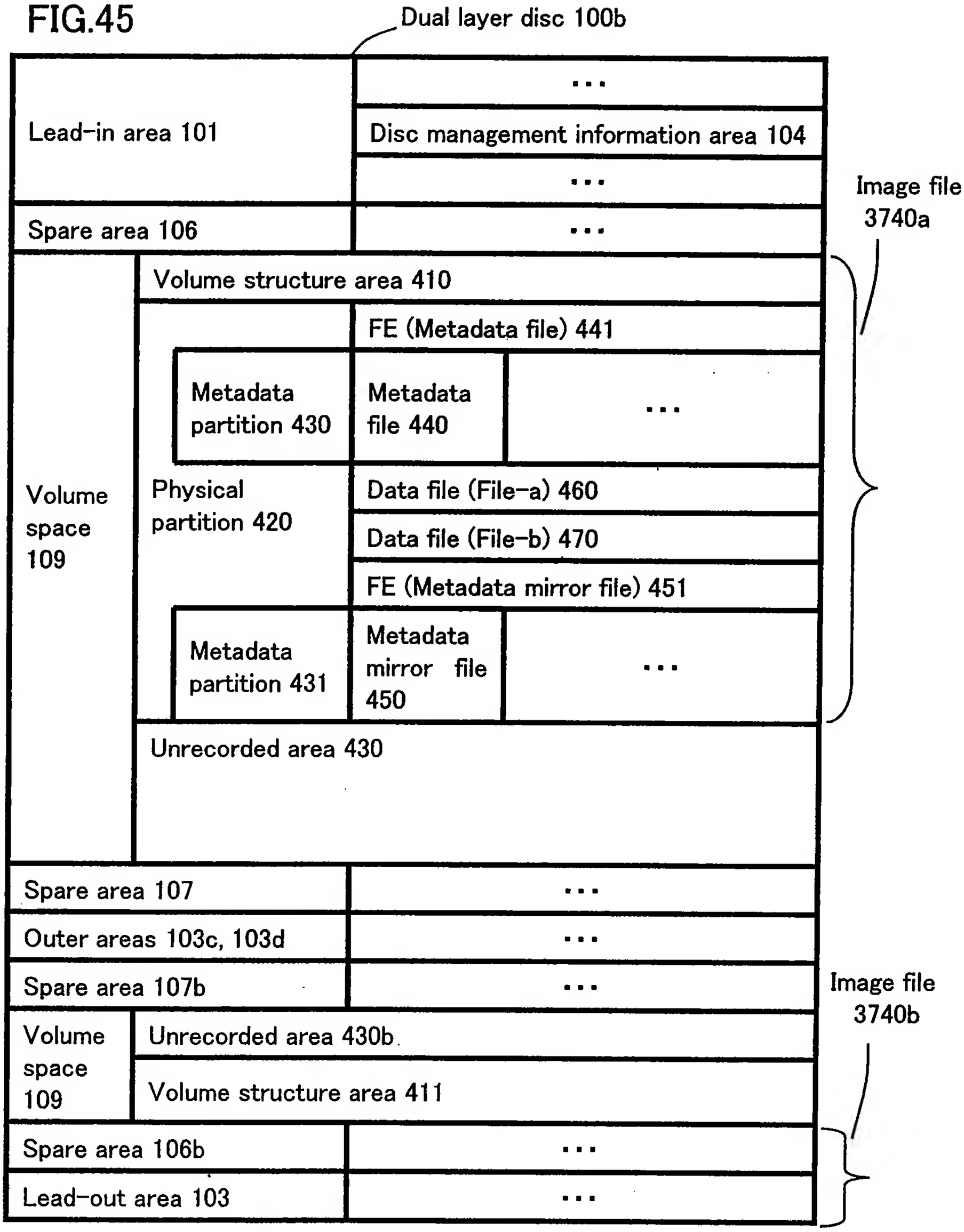

Dual layer disc 100b
Lead-in area 101
Disc management information area 104
Spare area 106
Volume space 109
Volume structure area 410
FE (Metadata file) 441
Metadata partition 430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
Metadata partition 431
Metadata mirror file 450
Unrecorded area 430
Image file 3740a
Spare area 107
Outer areas 103c, 103d
Spare area 107b
Volume space 109
Unrecorded area 430b
Volume structure area 411
Spare area 106b
Lead-out area 103
Image file 3740b

FIG.46

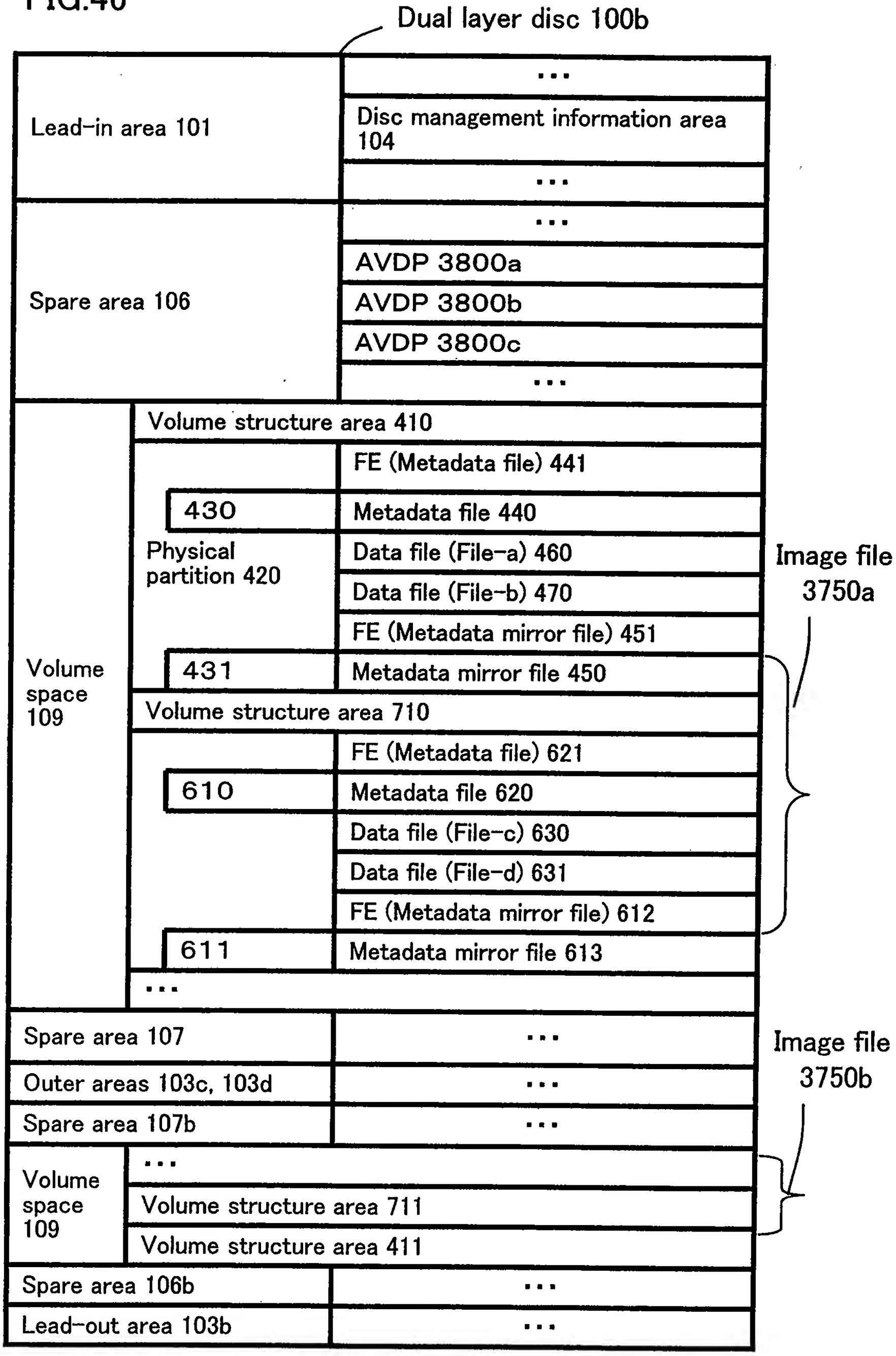

Dual layer disc 100b
Lead-in area 101
...
Disc management information area 104
...
...
Spare area 106
AVDP 3800a
AVDP 3800b
AVDP 3800c
...
Volume space 109
Volume structure area 410
FE (Metadata file) 441
430
Metadata file 440
Physical partition 420
Data file (File-a) 460
Data file (File-b) 470
FE (Metadata mirror file) 451
431
Metadata mirror file 450
Volume structure area 710
FE (Metadata file) 621
610
Metadata file 620
Data file (File-c) 630
Data file (File-d) 631
FE (Metadata mirror file) 612
611
Metadata mirror file 613
...
Image file 3750a
Spare area 107
...
Outer areas 103c, 103d
...
Spare area 107b
...
Volume space 109
...
Volume structure area 711
Volume structure area 411
Image file 3750b
Spare area 106b
...
Lead-out area 103b
...

FIG.47

Original location information 1012	Replacement location information 1013
Location information of AVDP 3600a	Location information of AVDP 3800a
Location information of AVDP 3600b	Location information of AVDP 3800b
Location information of AVDP 3600c	Location information of AVDP 3800c